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USSR Report

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

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USSR REPORT

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

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COMPUTER DEVELOPMENT IN USSR NATIONAL ECONOMY

Moscow SOVETSKAYA ROSSIYA in Russian 19 Feb 86 p 3

[Article by V. Yershov: "I Don't Understand Computer Intelligence"]

[Text] Recently, the people's inspectors found a pack of punchcards of incomprehensible content at the computer center of Tomsk Polytechnical Institute, alongside the YeS-1022 computer. The programmers and operators denied involvement in the discovered materials. Some specialists advanced the hypothesis that the computer was capable of independent thinking due to a plant flaw. The punchcards were placed in the machine. Letters appeared on the display screen. These were letters of the computer to its "female friend," the YeS-1060 computer, also operating within the system of Minvuz RSFSR [RSFSR Ministry of Higher Educational Institutions].

Here are the letters.

First letter. Dear friend! I of course realize how expensive each second of machine tinme of such a unique and high-speed computer as you is. Your exceptional cost--3 million rubles--is itself noteworthy. Nevertheless, I permit myself to break away from accounting to share some ideas that have settled within my memory units as a result of acquaintance with the operation of our institute's computer center.

I concluded after a long routine downtime that we computers are no more stupid than people, without mentioning reliability. Where man needs days and months, the computer of medium cost such as I requires minutes. With my modest capacities I, for example, am capable of performing tens of thousands of operations per second. And what about you! You can perform millions of operations per second.

Everything that we need from the administration is a constant load and regular preventive maintenance. However, I have begun to notice of late that the word "to labor" is not quite appropriate to what some of us are engaged in. Many of our colleagues are idle, are operating at undercapacity or are interrupted from payroll accounting to compute trade union dues. Were we really designed for this? Some institutes of our ministry, as I understood it, generally acquire us for show rather than for computations. But what a pity for these machines to suffer this fate! These are not computers but EVU--electronic computing decorations, acquired at government expense for purposes of prestige.

I don't know how it is with you, but I personally cannot understand this with my machine intelligence. If each hour of my time becomes more expensive than a deputy minister's day, what is the sense of acquiring us and leaving us unpacked in crates as happened with the Nairi-2 computer at the Rubtsovsk Branch of Altay Polytechnical Institute. The beautiful Nairi has been left unpacked for 10 years in the yard of the institute! Ten years! During this time, she has been transformed from a young, technically advanced machine to a weakly developed grandmother. If I were not a machine, I would cry like money thrown to the winds.

Or take the YeS-1030 at the Ustinovka Machine Institute. It stood idle for 4 years, cluttering up the room. And it cost 500,000 rubles. Simple office calculators are sufficient to estimate what the YeS-1050, costing 1 million rubles, at the Krasnodar Polytechnical Institute has cost the government since it has been idle since 1982. I think that we computers would never have permitted this.

Second letter. Dear YeS-1060! There is much I don't understand in your answer. You state as if many estimates are made as to whether or not the computer will be profitable at many serious institutes before the machine is acquired. And in other companies, with the exception of minimum preventive maintenance time, all remaining time is operating time. You accuse me of being too fast, but I cannot believe this at all, knowing about the operating experience of our ministry--Minvuz of the RSFSR. How do they load machines here?

For me personally, a standard has been confirmed for YeS-1022 computers--10 hours per day. However, I am rarely loaded all this time. My neighbor, the Minsk-32, has been idle almost 800 hours over 3 years and the YeS-1033 has been idle about 2,000 hours, while I personally have been idle 2,500 hours. And during this time, the institute purchased outside machine time costing 285,000 rubles!

At the Kuzbass Polytechnical Institute, for example, my namesake--the YeS-1022--computes an average of 3-5 hours instead of 10 hours per day. Because of nothing to do, I estimated that it could perform billions of operations during the remaining time. I won't even mention your capabilities, the excellent YeS-1060. The load of all the YeS-1060 computers being operated at the vuzes of the ministry comprises an average of 8.7 hours per day with the norm of not less than 20 hours. The operating schedules of computers are generally not confirmed by Minvuz RSFSR. And I think you know that this is the crudest violation of the instructions of USSR Gosplan and TsSU SSSR [USSR Central Statistical Administration].

Third letter. Dear friend YeS-1060! I am an old tin can filled with electronic trash. I, for example, do not know how to lie. When people find themselves in such situations that their accounts of completed computer hours are in arrears, they add and juggle as much as they need to. Even for us, inimitable one, this is not the same mold.

They imagine as many hours as they need at Udmurt and Petrozavodsk universities. They have wasted almost twofold more time than the YeS-1022 has operated at Novgorod Polytechnical Institute. And machine time is taken directly from thin air at Ivanovo Power Engineering Institute. It was indicated in the account at the Department of Electric Power Plants that the daily load of the computer was

almost 10 hours throughout the year. In fact, the computer was inactive for almost 7 months. And during all this time it was serviced according to the staff schedule of four persons and all four punctually received their wages. I was strained and tried to imagine what they would have been paid for if all my circuit breakers had burned up.

Dear YeS-1060! Help my to solve yet another unresolvable problem. Here is its content. Minvus RSFSR recommended machine time for students from 60 to 450 hours per year. In fact, let us say, it reached only 2.5 hours per year in 1983. I ask you, what kind of specialists are coming from the walls of these vuzes if one also takes into account that they are trained on unreliably obsolescent machines!

It would be interesting to know what the situation is in other sectors of the national economy? After all, if computer technology is being operated there as in the higher schools, then one can talk for a very long time about acceleration of scientific and technical progress. In my machine view, all this is nothing more than economic bungling. I am forced to interrupt our discussions. It seems I am being opened up and they are rooting around in my memory blocks. I categorically... Crack!

These letters seemed so interesting to us that it would not be right not to bring them to the attention of our readers and even more so to the managers of those departments and organizations in which intelligent computers are standing silent. For this reason we are printing them.

6521
CSO: 1863/170

NEED TO INCREASE COMPUTER UTILIZATION STRESSED

Riga SOVETSKAYA LATVIYA in Russian 30 Oct 85 p 2

[Article by N. Vorobyev, Chief of the Department of Computer Equipment and Control Systems for the Latvian SSR Gosplan: "A Scientific Achievement -- the Efficiency Factor Computer in Production"]

[Text] The Soviet people are focusing a lot of attention these days on becoming familiar with the new wording of the CPSU Program. This document puts special effort and conviction into stressing the idea that the progress of Soviet society and its progressive movement toward communism can and must be assured by accelerating the country's social and economic development. The CPSU envisions a fundamental renovation of Soviet society's material-technical foundation, including those that are based on achievements of the scientific and technical revolution.

Micro-electronics, computer technology and the information industry were called catalysts for progress at a CPSU Central Committee meeting on accelerating scientific and technical progress. It would be simply impossible now to accomplish the extensive automation in robotic and manipulator production without computer technology. It would not be an over-exaggeration to say that the computer has become an integral part of today's production equipment.

This equipment is effective, but it is also expensive and therefore we must carefully plan out its emplacement and use. Indeed, the volume of computer equipment still does not support the national economy's growing need for computers. Moreover, in a number of enterprises and republic organizations, such as the USSR Minlegprom's [Ministry of Light Industry] Latvian Scientific Research Institute of Light Industry, the Rigas Apgerbs Factory, the Physics and Energetics Institute of the Latvian SSR Academy of Sciences, and information and computer centers at the republic's Mintorg [Ministry of Trade] and Minkommunkhoz [Ministry of Municipal Services], computers often stand idle or are not used for tasks that involve calculations, in statistical problems or in operational control areas. And it is characteristic that even given this state of affairs, some economic leaders are asking planning agencies to increase the delivery of new machines. It is impossible to reconcile ourselves to this. It is obviously necessary to limit the unrestrained growth

in a number of ineffective computer centers and to decide the fate of those centers that are not providing the necessary return.

In June 1985 the science departments of SOVETSKAYA LATVIYA's editorial staff and the republic's Gosplan and Academy of Sciences held a "round table" discussion to extensively discuss the problems of increasing the effectiveness of using computers and automated control systems in locations where this technology has been put into operation. They also addressed recommendations covering how to improve the cadre training system for the growing information industry. Definite steps in this area have been taken recently in the republic.

At the present time an extensive array of measures designed to create and develop a Latvian Automated Control System (RASU [republic automated control system]) in the Twelfth Five-Year Plan has begun. An important and integral part of this work has to be increased effectiveness in the use of computer technology. Work leaders and primary designers for RASU inter-industrial complexes have been approved to improve the coordination of efforts in this area. Methodological hypotheses aimed at optimizing industrial automated systems have been worked out.

The Gosplan has also considered critical remarks expressed by "round table" participants relative to the timely training and retraining of cadre specialists. Many things are now being done to restructure "computer educations" in engineering VUZ's [institutions of higher education] so that graduates of these schools master the methods of working with computers, especially personal and built-in microprocessor equipment.

As is known, this new electronic equipment has found its way into general educational schools and professional-technical schools. A scientific research laboratory for school information problems has been created as a part of the Latvian State University computer center. Laboratory specialists have started to carry out the tasks of programming and methodological support for the republic's schools, technical schools and professional technical schools. Experimental classes to train both students and teachers on how to work with micro-computers, classrooms for methodological assistance, and instructor consultations on the new training program course, the Basics of Information and Computer Technology, have been developed.

Methodological work with computers is being improved in all ministries and departments, in major organizations, associations and enterprises. The goal of this work is to make maximum use of this equipment, improve its software, regulate the normative base for its use and make the best use of the advanced experience presented at the USSR VDNKh [Exhibition of the Achievements of the National Economy of the USSR].

During the Eleventh Five-Year Plan, the average annual saving from using computer technology in our republic exceeded 26 million rubles. Now more advantageous, optimized methods based on computer use are being used extensively in the republic's agricultural sector to allocate feed resources, fertilizer, and agricultural equipment and to make up feed rations on farms.

However, in a number of sectors the use of optimized methods is still far below the desired level both in the scale of use and in the effect that is has.

Certainly, there are a number of cases where computer equipment is providing a solution to social tasks and the solution still cannot always be evaluated by the sum of the economic effect. However, this characteristic of the, and I stress, important and sociologically necessary application of computer efforts must in no way justify the failure as a whole of one sector or another completing the normative efficiency coefficient of its capital investment in electronics.

Today the science of economics is being asked to define an entire methodology for calculating the functional efficiency of automated systems as much as possible and to raise it to the necessary level. Unfortunately, the existing methodology is still complicated and is not completely reliable in determining this important indicator. By the way, we should standardize our evaluation of the social effect from using computers by using simple, but sufficiently precise criteria. In short, there are still a number of items to work on in this area, and there is work to be done at the Latvian SSR Academy of Sciences' Institute of Economics which is the republic's primary organization for determining the economic effect of automated systems.

The tasks which the party is assigning for the Twelfth Five-Year Plan and for the period up to the year 2000 demand that a whole gamut of issues associated with the very rapid growth of the KPD [efficiency factor] of computers be resolved. These issues include the nature and volume of informational dialogue between the computer center and the individual sphere that it serves. A department is often unable to fully tax a computer since according to a long-developed tradition a computer center is not involved in the technological production process, but instead only develops statistical and bookkeeping information. Moreover, the technical level of contemporary computer centers allows them to transition into a qualitatively new level of electronic service -- resolving technological tasks of one type of production or another. This will make it possible to substantially increase our return from the electronic capacity that we now have at our disposal, but that we are still not yet fully utilizing.

12511
CSO: 1863/115

COMPUTER - IN LIMBO

Frunze SOVETSKAYA KIRGIZIYA in Russian 27 Dec 85 p 3

[Article by A. Razhapayev, department chief, Committee for Scientific Consultation, KiSSR Academy of Sciences]

[Abstract] Although the Information and Computation Centers at the KiSSR Ministry of Agriculture and Ministry of Automobile Roads have been in operation for five and eleven years respectively, their performance is still highly inadequate. They do not provide the necessary services and they operate at a financial loss. The main reasons are a weak technical base for information processing, a poor organization of staff activities and job assignments, and poor economic planning. Consequently, production output and livelihood in the Kirghiz SSR Suffer while the return on investment in science and technology diminishes. This can be cured by a radical change in the management's attitude and taking the computer out of limbo.

2415/9835
CSO: 1863/131

COMPUTER - ON LEAVE OF ABSENCE

Minsk SOVETSKAYA BELORUSSIYA in Russian 24 Dec 85 p 3

[Abstract] Poor judgment of purpose and poor timing of purchase have resulted in misapplication of computers in BSSR enterprises, a typical case in point being the "Automatic Management System - Farm Machinery Manufacture - Bobruysk". A computer is thus underutilized, not adequately used for coordinating production activities and raising the efficiency of industrial operations. It has, in effect, taken a leave of absence for performing nonessential work. The task before the Committee for Scientific Consultation is to deal with this problem. It feels much obliged to comrades Pakhilko, Butkin, Kubrakov, Karpitskiy, Shibeko, and Kurkov for appearing before staff gatherings to explain the causes of all these deficiencies. Progress in this area will be monitored by the Committee, which is to meet next August again to discuss the problem.

2415/9835
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HARDWARE

CONVERSATIONS WITH IKAR

Moscow IZOBRETATEL I RATSIONALIZATOR in Russian No 1 Jan 86 pp 6-11

[Article by A. Vaysman, correspondent for IZOBRETATEL I RATSIONALIZATOR.]

> [Text] Production workers have begun training to work with a device that forces a computer to respond to the operator's voice. Working with the machine is being greatly simplified. The device still has limited application, but at least it has begun.

"He plucked up his courage, inhaled a little air, and shouted with full voice: 'Open, Sesame!' And immediately the door flew open."

Isn't it a fascinating idea to open the secret door with one phrase. Imagine that robots obey our word and that automobiles, excavators, electric locomotives, and machine tools understand our commands. We dictate something into a microphone, and a printing device produces prepared text. In brief, any controlled computer understands and obeys.

The problem of automatic recognition of human speech is becoming increasingly urgent each day. Now, it is necessary to "converse" with a machine exclusively in programming language. In addition, the program written on paper still has to be transferred to machine storage -- punch card, punch tape, magnetic tape, or magnetic disc.

Why is it so difficult to teach an "artificial brain" to distinguish human speech? A "natural brain" learns to do this quickly.

Here is the difficulty. Unfortunately, up to the present time, we don't know precisely how (however paradoxical it sounds!) people speaking in the same language understand one another well despite differences in diction, pronunciation, and intonation.

It may be conjectured that recognition is aided by some kind of definite physical parameters and their relationships that are constantly in the speech signal which are characteristic to any speaker (we do not take into account people with speech defects) and do not depend on individual peculiarities of pronunciation of the same text. Scientists call this the "phonetic code." Our brain is 10 billion nerve cells with numerous connections with one another which easily "grasp" this code and

decipher it; it is indifferent to whether the conversation partner speaks rapidly or slowly, "intelligently" or uneducatedly. But how is the recognition process really accomplished in the brain? We do not know the mechanics of this process.

So how can we teach a machine to understand our speech? By having described the speech signal mathematically. It still does not understand any other language. For the present, it is enough: the mathematical "formula" for the phonetic code is that minimum of information that is necessary for recognition of the speech signal by a machine in whatever form this operation takes place and independent of how much it coincides with speech recognition by man.

And, although only for the solution of very limited problems, such devices already exist. How one of these, the IKAR (a. s. No. 1,040,512, 1,076,938, and 1,094,049) works, I asked S. B. Avrin, candidate of engineering sciences and one of the developers, to tell us.

Now, the Main Capital Construction Administration of the Moscow city ispolkom is beginning to teach a large group of its associates how to work with computers. The course includes instruction on IKAR. Working with the speech device, it is, for the present, necessary to adjust to it to some degree, trying to pronounce words always more or less in the same way and not varying the intonation very much.

Let us suppose that one of the workers questions the computer through IKAR: "Plan fulfillment for construction and installation projects during the second quarter." The machine, having understood him, searches the appropriate data and presents the data on the visual display. It is understandable, if the words of the inquiry were put into the memory of the machine linked to the input device. There can be up to 200 such words. They can be substituted, that is, "erase" one and write in others.

"But how does the device recognize speech communication?"

"Recognition consists of two elements: instruction of the system and actual recognition. In instruction, each word of the vocabulary needs to be pronounced one time. The memorized characteristics of the pronounced words will be used as standards for comparison during recognition. These characteristics are obtained in the following form: from the microphone, the signal enters a spectral analyzer which represents a set of sound-frequency filters that are standard for the radio industry. At the outputs of these filters, we obtain signals which, as in input speech, develops in time. Thus, each word is represented as a three-dimensional "picture" with the coordinates -- amplitude, frequency, and time. The "picture" defines the points (control characters) characteristic for a given word that are also remembered as a standard for that word.

During recognition, as during instruction, the control characters for the pronounced word are defined, and the set of control characters is compared with all standard sets, after which the most similar are selected. The word with the set of control characters that has been selected is recognized. So that the "conversation partner" (the person) can control whether the machine understands him, it writes on the indicator panel what it has heard. The standards can be used many times, and for this they need to be preserved in the memory of the computer with which IKAR operates. Insofar as the device understands only a specific person to whose speech it is "attuned to" at a given moment, the person must name himself before the work

begins. At different times, 256 workers, each of whom can use a vocabulary of 200 words, can associate with IKAR. If the number of conversation partners is smaller, they can expand the vocabulary correspondingly.

"How often does IKAR make mistakes?"

"If a person follows the pronunciation rules that have been mentioned, then they are rare. IKAR correctly understands 95 out of 100 words even with a high noise level (80 db). And if a person is used to working with IKAR, it will make even fewer mistakes."

The device can be applied in automated design systems (speech control of input and corrective graphic and other data), automated control systems (data input during control of quality of manufactured goods, in storage and postal operations, and so forth), as the input link in information-search systems, for direct input and for program corrections in computer work, programming machine tools with numerical program control, control of various instruments and mechanisms for invalids, and so forth. There are data to the effect that devices like IKAR can increase labor productivity in programming, in design automation, product quality control, and so forth, by 25 to 90 percent.

9645
CSO: 1863/173

HIGH-PRODUCTIVITY COMPUTERS

Moscow TEKHNIKA I NAUKA in Russian No 12, Dec 85 pp 29-32

[Article by V. Mel'nikov, academician, and Yu. Dadayev, professor]

[Abstract] The problem of maximizing the productivity of computers is examined, a distinction being made between potential productivity characterized by the computer speed and much lower actual productivity with the computer interfaced with peripheral equipment which operates according to its logic under load. Drawing on analogy to human life, the problem of designing and building a computer so as to realize its potential productivity in actual operation is treated as a problem of compartmentalization or bufferization and compatibility or parallelism. Attainment of higher computer productivity by implementation of these two principles is demonstrated using a typical variant of a processor memory array and a typical structure of a multiprocessor complex, with the pipeline principle applied to peripheral equipment. Ways to further increase the computer productivity must be sought in the software, namely optimization of numerical methods and their algorithms as well as of vector processing methods and of programming in truly high-level languages. Another factor contributing to a still higher computer productivity will be very-large-scale circuit integration facilitating departure from restrictive conventional architectures.

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ANALYSIS OF CERTAIN SYSTEMS FOR SWITCHING PARALLEL COMPUTERS WITH A SINGLE STREAM OF INSTRUCTIONS

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 6, Nov-Dec 85 (manuscript received 7 Jun 84; after revision 5 Apr 85) pp 26-29

[Article by G. I. Shapakovskiy and B. A. Morozov]

[Abstract] A study is made of switching systems with individual addressing, investigated by machine modelling to obtain results quickly with an accuracy sufficient for practical applications. The systems studied involve a single stream of instructions with multiple data streams. Methods of conflict resolution in the systems are analyzed. The results of the modelling are presented in a table of equations, featuring equations derived by approximation of curves by the least squares method with an error of not over 5%. The results of the modelling were used to develop a computer system in the department of electronic mathematical machines of Belorussian State University, indicating that systems with channel switching can be used only with small network size due to the great increase in packet transmission time as network dimensions increase to over a few dozen processors. An Ω network with message switching has high speed, but requires many switching elements and connecting busses. Computing media are suitable for switching of regular packets but are quite slow with random packet lengths. The best type of system for large networks with 1,000 or more processors is the single-level network which achieves high speed with the minimum number of switching elements and connecting lines. Figures 3, references 6: 4 Russian, 2 Western.

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DEVELOPMENT OF SOFTWARE ENGINEERING IN THE USSR

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 6, Nov-Dec 85 (manuscript received 13 May 85) pp 13-17

[Article by B. G. Senyaninov and V. N. Tsoy]

[Abstract] An industrial technology in the intellectual sphere of human activity is required to satisfy the growing and presently unsatisfied demand for quality personal computer software. Soviet developments on programming technology are expanding in three main directions: work based on new principles and results of fundamental research; work summarizing the practical experience of program developments; and work adapting foreign experience and technologies as applicable to Soviet conditions. Such progressive methods of software development as structured analysis, design and programming, structured and functional testing, top-down and bottom-up development, dialogue operation and electronic mail, cooperation and division of labor in programming teams are being utilized. Industrial production increases productivity by separation, concentration and specialization of programmers' activity, standardization of processes, rules and methods, complete mechanization and automation of joint programming labor and systematic monitoring of the quantity and quality of work based on objective indicators. The characteristics of a number of the Soviet programming technologies are briefly noted. Figure 1, references 3: Russian.

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UDC: 681.3

USE OF SPECIALIZED SWITCHING NETWORK FOR SORTING

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 6, Nov-Dec 85 (manuscript received 9 Jul 84) pp 29-36

[Article by Ye. V. Suvorov]

[Abstract] Some possibilities are studied for implementing information-logic problems, particularly reordering of files in a specialized homogeneous structure referred to as a λ matrix. The homogeneous matrix analyzed is a modification of a λ matrix suggested previously for operations involving data structure transformations. The system implements a broad set of data structure transformation operations in addition to the ordering procedure. The article briefly describes the structure and properties of the λ matrix and presents definitions for a number of data structure transformation operations. Figures 7, references 8: 5 Russian, 3 Western.

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UDC: 681.325

SUMMARY METHOD OF SYNTHESIS OF LOGICAL RELATIVE ADDRESSING

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 6, Nov-Dec 85 (manuscript received 12 Mar 84; after revision 19 Dec 84) pp 36-40

[Article by V. P. Denisenko, S. I. Yusifov and N. P. Starodus]

[Abstract] A method of forming increments is studied allowing storage of the numbers of codes and increments and computation of the codes themselves, which can serve as one argument of a logical function. One possible version of structural implementation of two-dimensional logical relative addressing is studied and several particular implementations of a generalized method of relative logical addressing are briefly described. A control device is suggested on this basis allowing an increase in the number of jumps from any address to an address while retaining limitations on coding, eliminating or reducing the number of empty instructions and therefore correspondingly increasing the productivity of computers.

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METHOD OF ESTIMATING RESPONSE TIME IN DIALOGUE COMPUTER SYSTEMS

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 6, Nov-Dec 85
(manuscript received 23 Apr 85; after revision 21 May 85) pp 54-59

[Article by Ye. A. Semeshko]

[Abstract] Response time is an important characteristic of time-sharing systems. The traditional estimate of response time in dialogue systems, based on its mathematical expectation, is insufficient since it does not consider the measure of its scattering of the random quantity and consequently does not allow determination of the boundaries of the interval within which true response time lies with a predetermined probability. This article presents a method of estimating response time for use in planning a dialogue system. Based on assigned computer system and communications channel structure, the traffic is determined for each computer and the optimal number of terminals in the system determined. Equations are presented for computation of the mean response time once these figures are known, as well as its standard deviation. Figures 3, references 4: Russian.

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SYSTEM FOR AUTOMATED PLANNING OF STRUCTURES OF COMPLEX SYSTEMS BASED ON RELIABILITY CRITERION (DISON)

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 6, Nov-Dec 85
(manuscript received 21 Dec 84; after revision 16 Apr 85) pp 74-78 and 98

[Article by B. L. Volkovich, A. F. Voloshin, V. A. Zaslavskiy and Yu. V. Bondarchuk]

[Abstract] This work describes applications and system software for a dialogue system for automatic planning of the structures of complex technical objects considering the reliability criterion and limitations on technical and economic characteristics such as mass, cost and size. This DISON (dialogue system for optimizing reliability) can be used to formulate problems of selection of a structure for a technical object having the maximum reliability while meeting requirements for other technical and economic characteristics, generating interactive algorithms for solving the problem within the framework of a single information environment. The DISON system has been introduced at a number of enterprises and is now in use in planning and design departments.

The system and application software are functionally independent and open for expansion. They can be used in developing other application program systems. References 10: Russian.

6508/9835
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UNIVERSAL DOS YE.S. MACROGENERATOR

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 6, Nov-Dec 85 (manuscript received 13 Jun 84; after revision 8 Jan 85) pp 84-87

[Article by V. I. Voyush, L. A. Yadrova, L. P. Azanovich, and T. S. Timoshenko]

[Abstract] The major purpose of the macrogenerator described in this article for the operating system of the Ye.S. series of computers is the utilization of macroenvironment elements in any text. The input information used by the generator is an arbitrary sequence of characters such as a program text written in any programming language or a document. The output information is the text obtained after processing by the macrogenerator of the macros included in the initial text. The macrogenerator features a general macro calling syntax similar to that used in the DOS Ye.S. macrogenerator, a well developed arithmetic apparatus, and the availability of debugging facilities. Each macro call in the input text is replaced by the macrogenerator by the text of the corresponding output macro. The macro call may be followed by one or more operands. The macrogeneration algorithm can be reduced to replacement of the parameters and variables with values, recognition of macro calls and substitution of output macro texts, alteration of the sequence of text fragments and interpretation of macrogenerator controlling operators. The macrogenerator operates at 300-700 operators per minute on the Ye.S. 1035 computer, depending on initial text content and frequency of occurrence of macros within the text. References 4: 2 Russian, 2 Western.

6508/9835
CSO: 1863/134

UDC: 681.3.06

INFORMATION VECTOR OF STRUCTURE IN REMOTE DATA PROCESSING SYSTEM

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 6, Nov-Dec 85 (manuscript received 13 Jun 84; after revision 8 Jan 85) pp 114-115

[Article by V. A. Alekseyeva]

[Abstract] The BLANK software system has been developed on the basis of screen formatting programs to facilitate the work of programmers in describing and debugging programs to organize remote data processing involving filling out blanks and questionnaires. Designed for use by PL-1 programmers, the system facilitates screen formatting and maintenance of the relationship between the screen format and structure of the data file being updated. The unambiguous relationship between blanks on the screen and data file structures allows the creation of universal searching programs. The system was used to create universal file editing programs for the SETOR data base management system version 2.0 allowing direct information retrieval based on the primary key with subsequent search using an arbitrary set of search patterns. The system can be used to write dialogue programs for any remote data processing system utilizing the Ye.S. 7920 display system.

6508/9835
CSO: 1863/134

FUTURE OF AUTOMATED CONTROL SYSTEMS DISCUSSED

Moscow EKONOMIKA I MATEMATICHESKIYE METODY in Russian Vol 21, No 5, May 85 pp 920-934

[Round-table discussion: "Problems and Prospects for the Development of Automated Control Systems," conclusion. For beginning see Nos 3 and 4 of this magazine for 1985]

[Text] Developing Experimental Methods of Investigation of Models

[Golub, L. G. candidate of technical sciences, division chief of the Scientific Research Institute of Construction of the ESSR Gosstroy]

It is well known that optimization and balance problems in the ASU account for only 3-5 percent of the overall number of problems and the great scientific potential accumulated in the area of economic and mathematical modeling is utilized in practice to an insignificant degree. Many of the reasons for this phenomenon have been discussed already. I would like to draw attention to one circumstance which is usually missed although the parties "guilty" of it are mainly the developers of ASU's.

How much time does it take to create the optimization models used in the ASU? The models discussed by the comrades from the ministry of fishing were developed over the course of 5 or more years and the problems mentioned by N. B. Mironosetskiy took just as long. For almost 20 years our collective has been working on optimization models for construction, but extensive utilization of these began approximately 10-12 years after they were created.*

From the methodological instructions for the development of ASU's it follows that approximately a half-year is spent in investigation, a half year in the statement of the problem, a year for programming and a half year for overall testing of the system. For the basic, most significant part of the work--the statement of the problem--one uses at best a half-year out of the 2.5-3 years allotted for the entire work cycle. In fact, and all ASU developers know this, it takes years to set up problems adequate to the goals of control and at the

* For a description of these models and the experience in introducing them see our magazine for 1981, Issue 1; 1982, Issue 6; and 1984, Issue 3.

same time simple enough so that they can be realistically used by thousands of ordinary specialists at enterprises, in industrial associations, in construction trusts and so forth. This means that the models must be comprehensible and simple to use, and this can be achieved only with extensive experimental investigation of them and the object of this investigation should be not only the economic and mathematical models themselves, but also the technology of control, the conditions for the operation of the ASU and so forth.

An important aspect is related to the problem of the "psychological barrier." The efforts of mathematicians and economists as well as everyone else who participates in the development of an ASU are directed toward having the model produce good results, that is, toward a plan of the highest possible quality. In fact for the manager of the enterprise the plan is only one of the aspects of the activity. Such a manager each day makes dozens of operational decisions and for this he must have a clear idea of the interconnections of the work of all subdivisions of the enterprise and its functioning as a whole. To make such decisions it is necessary to have information. The manager has become accustomed to forming independently, "by hand," an idea of the production and economic situation precisely on the basis of the construction of similar plans. If a machine produces the annual plan the manager turns out to be separated from the information which has composed the basis of his management work. In order to fill in this gap he must repeat by hand certain of the aforementioned calculations that were produced by the machine and as a result he comes up with a different variant of the plan. Naturally, one gets the impression that he is rejecting the machine variant and continuing to work with "his own" variant, that he is rejecting the ASU or, in any case, he is far from taking full advantage of its possibilities.

Now, when we are expecting the appearance of the fourth generation of machines which offer managers sufficiently rich possibilities, a serious role begins to be played by the provision of managers with information, and no less of it than is needed when working without ASU's. It is not only a matter of whether or not the management can call up various data on the screen of the terminal; it is more important that he be able to adequately perceive this information and be able to use it like those indicators in whose calculation (or in the formulation of initial principles of calculation) he has directly participated. This requires in our ideas about the development of economic and mathematical models and information support for the ASU. In order to solve the problems that arise here it is also necessary to strengthen the experimental aspect of research. By experiment I mean not simply calculating according to a random set of data, working by the trial and error method, but a goal-directed many-year-long experiment as a scientific method of investigating economic and mathematical models which makes it possible to accumulate quantitative and qualitative information for its theoretical generalization and for the production of practical conclusions.

A Well-Arranged System of Planning and Organization of ASU Developments Is Needed

[Glushchenko, K. P., candidate of economic sciences, laboratory chief of the NIIsistem of the Ministry of Instrument Making, Control Systems and Automation Equipment]

One of the most crucial problems arising with the creation of the ASU is the interconnection between the work for improving the structure of management and its automation. As Academician L. V. Kantorovich has already said, automation of organizational and economic control and improvement of the intrabusiness mechanism at the enterprises are carried out as though in parallel, independent of one another. Automation of data processing can and should provide for information computer support precisely in order to improve economic methods of control.

But the actual automation of assembly, transmission and processing of data, as practice shows, is reflected very little in the final results of the activity of the enterprise if it is not accompanied by improvement of control and is not built into its technology and does not mesh organically with the administrative staff. Today this circumstance is well-recognized by the developers. Many say that now that it is not a problem of programming (the more so since in the past 10 years the number of programs has increased and their qualifications have also gone up) but a matter of precisely what they are programming. The corresponding methodological guidelines do not give a proper answer to this question. Even in scientific work this problem is not considered frequently or completely.

The NIIsistem has made an attempt to solve this problem. Development has already been completed on methods in which we have tried to join the work for improving economic methods of management with its automation into a continuous unified process.

A number of writers have touched upon the problem of organizing planning for automation of management as a whole. Many shortcomings which have been discussed here are related to the fact that precisely this problem has not been solved.

The first difficulty is the lack of coordination of the work at various levels: scientific research, applied developments, and the introduction and operation of concrete systems. The Tsentrprogrammsistem NPO was called upon to create standard program software for the ASU, to sell it and to provide documentation for it. But the supply of standard programs in this NPO is formed on the basis of proposals from developers, that is, they do not what is necessary to the consumers but that which the developers are capable of producing. It is practically impossible to construct software for an ASU using this supply. The set of packages is not complete and they frequently cannot be used together since the developers to not have a unified approach and there is no regulation of their activity on the part of Tsentrprogramsistem, and there are no interfaces between the packages. As was already noted, it is simpler to write one's own software. True, there is the complex of packages ISUP, but the results of its introduction are fairly

modest, it far from always corresponds to the needs of production, and it cannot be started up everywhere.

The second difficulty is the lack of a methodological center which could be assigned the duty of engaging in theoretical development and coordinating them. Each institute does this in its own way based not on the needs of production but on their own preferences and capabilities. The division for computer equipment of the USSR Gosplan is increasingly shifting the center of gravity of its work toward the distribution of technical means among the groups of ministries and the process of automation of management itself is practically not planned centrally. If one takes Soyuzsistemprom, the organization which creates an extremely considerable part of all automated systems in the country, its activity is planned only at the level of the ministry.

Where do the enterprises which are ASU clients and the developers meet? Unfortunately, to a considerable degree this meeting is random. The developer organizations search for clients and the enterprises somehow or other find developers, but this process is not organized and not regulated. Many developer organizations engage in the creation of systems of various levels and for various branches, each of which has its own clearly expressed specific features. It frequently happens that there are 150-200 people working in the ASU design bureaus, and developments are being done in 10 different areas so one can see clearly just how insignificant are the forces concentrated in each of them.

In order to improve the quality of work for the creation and introduction of means of automation of organizational and economic management it is necessary to have a well-arranged unified system and clear-cut specialization of everyone who is involved in the process of automation of management in the national economy. And there are very many organizations involved in this process--academic and branch institutes, planning and design bureaus for ASU, and so forth. Some of these should engage in methodological problems while others should engage in the development of base systems for the introduction of ASU's on a standard basis. Since the complete cycle of development and introduction of the system (including model apparatus, software and so forth) requires 5-10 years, the existing policy for developments does not stimulate high quality. Organizations engaged in ASU's have a clear-cut plan--to produce a system in 2-3 years, and nobody wants to take the risk of realizing principally new systems when they do not know whether or not they will be introduced within the allotted time period (this pertains also to technical support). It is necessary to single out base organizations at which they would experimentally introduce promising developments and which would not be bound by strict time periods for output, a high effect and so forth. On the whole this problem can be solved only through the development of a unified program as a part of the program for improving management as a whole. Here it is necessary to plan not so much the formal side of the matter (not indicators like the general effect, the need for resources, computer equipment and so forth), but precisely the content of the given process.

Delving More Deeply Into the Essence of Real Management Situations

[Zhitkov, V. A., candidate of technical sciences, laboratory chief of the TsEMI of the USSR Academy of Sciences]

Automotive transportation is one of the first branches to begin to apply economic and mathematical method (in Glavmosavtotrans--since 1963). A good deal has been done during this time. In order to analyze the state of affairs with respect to the introduction of economic and mathematical methods, we studied all of the documentation for the past 20 years (orders work notes, report data) and utilized various indicators. For example one can calculate the ratio between the volume of cargo whose shipment was planned with optimization methods and the overall volume of shipments; this indicator reached its greatest value in 1978, amounting to about 8 percent. Subsequently it began to decline and now is is approximately 5 percent.

But the volume indicator is possibly not the best one for evaluating the role of computers in solving management problems. In transportation it is correct to utilize the different unit of measurement--the route-assignment for the vehicle during day of operation. Today the ASU of Glavmosavtotrans annually issues approximately 330,000 optimized routes, that is, approximately 3 percent of all the route-assignments developed in this main board. Of this number about 60 percent of the optimized routes are used. We discovered more than 10 "external" reasons for this phenomenon, and about 25 percent of the routes are not used because of the cargo dispatchers and cargo recipients, and about 15 percent--because of the transportation itself.

Why do the cargo dispatchers or the cargo recipients violate the optimized routes? The fact is that when introducing mathematical means of solving problems of transportation planning we relieve the real management staff of any functions and thus we take away some of its authority. Moreover all of the staff workers have other functions and other authority, but the ASU not only does not contribute to carrying out the corresponding tasks, but does not take on responsibility for the use of the optimized routes which it has drawn up. It turns out that this is not at all an easy problem.

Let us give an example. At the beginning of the 1970's an attempt was made to introduce economic and mathematical methods when drawing up routes for shipping bread throughout Moscow. The optimization methods made it possible not only to draw up economical routes, but also to provide for the delivery of bread to any point in the city at a given time. Through administrative methods we managed to keep this task in the foreground under operating conditions for approximately a month. For the first 2 weeks the developers contributed to the introduction of the system, then for 2 weeks it worked relatively easily, and then the system was removed although the delivery plans had been drawn up well and 10-15 percent were saved valuable expenditures on each route. The reason was that the distribution of the effect, which was manifested for economically independent participants in the process (plants, trade and transportation) did not correspond to the structure of expenditures on automation of planning and with available means it was possible to achieve this correspondence.

Everyone knows that real tasks are multicriterial, but in optimization calculations in practice almost always only one criterion is used. Real problems are not characterized by strict limitations; they typically have less rigid conditions, but this circumstance is rarely given any attention. In brief, it is necessary to improve the mathematical apparatus that is used. But the improved form of the mathematical apparatus produces full-value success only when the developers of the models penetrate deeply into the essence of the real management situations. We have concentrated our efforts primarily on questions of solving problems, but we have not devoted enough attention to problems of goal setting, selection and statement of problems. How does the economic and mathematical model relate to various concrete stages in planning activity and how is the realization of the plan ensured--these questions, as a rule, are not considered by mathematicians or developers of ASU's. Not only the plan is important, but also the planning activity itself, which, as was already noted, makes it possible for workers of the management staff to successfully perform other functions.

Scientific and Organizational Questions of Improving ASU Developments

[Marakov, V. L., corresponding member of the USSR Academy of Sciences, director of the VNII of Problems of Organization and Management of the USSR State Committee for Science and Technology]

The problems being discussed at the round table have many aspects. I wish to concentrate attention on two scientific and one organizational issue.

The first of these is the development of a technology of management. This term sometimes appears in articles in our country and abroad and it has even been heard at the round table, but so far it has received practically no scientific development. There is no clear-cut definition of the technology of management or a description of it either. If we had such a description we could correctly pose the question of discipline in the observance of a technology of management at any level: at enterprises, in ministries and in the Gosplan. Then it would be simpler to discover the guilty parties since it would be clear who in the chain of management technology is not meeting which requirements or is not performing various actions that are envisioned. I know of certain works in this area but they are far from encompassing the entire subject, and the issue is very important.

The second scientific problem involves models of combination of centralized and decentralized regulating mechanisms. Centralized planning is the basis, and regulation is an auxiliary instrument which creates conditions for effective action of the national economic plan. The study of this issue both from the political-economic and from the mathematical standpoint, it seems to me, is lagging far behind the requirements of practice. But what does this issue have to do with the subject of our round-table discussion? The fact is that ASU's also must take into account the indicated aspects, and their structure and properties must bear the imprint of the corresponding conditions--independence of the enterprises, cost accounting [khozraschet], self-financing and, of course, a centralized plan. But, in our opinion, modern ASU's do not have sufficient auxiliary properties.

Finally, the organizational issue. A good deal has been said at the round table about the fact that the creation of the ASU has entered a mature phase when industrial development is necessary. It is necessary to put the systems "on line," and we need service and adjustment organizations which will carry out the corresponding work according to the rules of industrial production. All these issues are indeed crucial, but the work for creating ASU's is not adequately planned. But it seems that in the modern stage when solving these problems one should follow not the line of stricter administrative rules, that is, not plan in a more decentralized way, not monitor the fulfillment of the plans more strictly and so forth, but take another path.

We are speaking about a new type of scientific production association (NPO) whose product would be ready for industrial utilization right away; and such an NPO would be headed by an academic scientific research organization which would be responsible for the theoretical and methodological side of the matter. At the next level would be the design bureau, the cost-accounting organization in charge of design developments which creates mathematical software, and so forth. At the third level would be the enterprises or the series of enterprises that are included in the given NPO and produce the final product of the association, this is the place where they say: "Yes, indeed, an industrial product has been created which can be purchased and the person who has purchased it will have no troubles." It would probably be possible to find legal forms to ensure the functioning of such an organization whose various levels would differ in that they would be under the jurisdiction of various departments. This is not a purely administrative solution to the problem but one which presupposes an orientation toward cost accounting. If the matter is arranged well and correctly included in the economic mechanism, such an organization will produce an appreciable effect. Of course this is only an idea so far, but if we do not thing about its concretization and realization (as is true of any kind of ideal like this) it will not get off the ground.

Better Accounting for the Information Needs of Engineering and Technical Personnel

[Blazhis, B. Yu., candidate of economic sciences, deputy director of the Institute of Economics of the Lithuanian SSR Academy of Sciences]I

It has been noted at the round table that usually the planned effectiveness of the ASU is higher than that which is achieved in practice. We studied this problem at industrial enterprises of Lithuania and found out that this conclusion is not precisely correct: indeed, in approximately the first 5 years of the functioning of the ASU's the level of their effectiveness is lower than that earmarked, but then it rises and exceeds the planned level. Apparently this situation is brought about by a number of circumstances: first, the initial complex of tasks of the ASU in the majority of cases does not provide for the necessary economic effectiveness and essential changes take place subsequently, during its expansion; in the second place, newly designed ASU's do not correspond well to the requirements of the real system of management of objects; in the third place, it takes a certain amount of time for the introduced system to adapt, for the users to acquire the necessary skills, for information ties to be arranged and so forth. If

attention is paid is paid to all this ahead of time, apparently, the ASU can approach its planned level of effectiveness and achieve it significantly sooner than 5 years after it has been put into operation. In the republic we have also compared the effectiveness of various scientific and technical measures and it has turned out that it is lower than average for the ASU. This shows the need to improve the quality of developments in the area of the introduction of computer equipment into management.

A questionnaire was circulated among engineering and technical personnel and employees regarding means of increasing the effectiveness of ASU's in industry. Many ways were pointed out, but there were two main ones: 1) more fully taking into account the information needs of engineering and technical personnel and employees, and 2) increasing the efficiency of information processing. Incidentally, it is clear that the second path is a part of the first one, for efficiency of processing information is one of the most important requirements of the user of information.

Apparently the time has come to raise the question of providing for coordination of the creation and development of existing ASU's with increased initiative on the part of the broad masses of workers both in solving problems of introducing technical equipment themselves and carrying out the main task for improving production management. Every serious economic experiment has the goal of increasing the initiative of the workers. But so far it is unclear how to make progress in resolving this issue with the development of the ASU. Nonetheless it is quite obvious that even now the ASU's should exert a greater influence on party and trade union organizations in studying all aspects of the activity of production collectives and analyzing social issues. If one uses the introduction of computer equipment and economic and mathematical models for increasing initiative as well, the economic effect will also increase significantly.

Proceeding From the Demands and Possibilities of Practice

[Danilov-Danilyan, V. I., doctor of economic sciences, laboratory chief of the Academy of the National Economy under the USSR Council of Ministers, professor in the economics department of the MGU imeni M. V. Lomonosov]

I shall discuss issues that are mainly methodological in nature. Much of what has been said at the round table can be interpreted as a statement of the disparity between economic and mathematical modeling and theory, on the one hand, and practice and economic reality, on the other. How and with to bridge this gap are undoubtedly methodological issues. In my opinion, within the economy and outside it there are an immense number of tasks whose resolutions should involve optimization, and optimization models should not be applied only in theory, but with a real practical return. But the successful development of this process is being largely impeded by the fact that frequently we approach the problem "from the wrong side" instead of searching in life for tasks to which it would be correct to apply optimization methods and conditions which ensure success of this application, we try to squeeze the real economy and its elements into prepared optimization schemes. The chances of success with this approach are small and it is more probable that an important and useful project will be discredited.

It has already been noted at the round table that the developers themselves do not devote enough attention to practical utilization of the models. Let us add that up to this point this problem has not been the object of serious scientific research. Most frequently we do not have enough ability to solve problems of precisely this kind. That very point which is raised by the specialist in modeling when he has written the last formula into the model or by the programmer when he has completed the program frequently becomes an invisible barrier between the model and its practical utilization. Many articles--by L. G. Golub, R. Ya. Levita, N. B. Mironosetskiy and others--have a common pervasive idea which we should like to decisively support: it is necessary to proceed as actively as possible from practice itself and arrange the closest possible contact with the future user in stating the problems, forming models, resolving concrete issues of a computer and information nature, and selecting forms of contact between the user and the computer. It is precisely this path that can expand the range of problems solved by the ASU, and not the establishment of an normative, for example, the percentage of optimization problems in the ASU--such measures cannot produce any results.

O. M. Yun correctly recalls that the tasks that are needed in practice are characterized by a quality of indefiniteness, a considerable amount of imprecision of data, and poor structure, which has also been mentioned by V. A. Zhitkov and others. O. M. Yun noted that in order to overcome the barrier between the model and practice which is brought about by indefiniteness, the latter must be included in the model itself. In principle there is no objection to such a thesis but the fact is, it seems to me, there are practically no models which clearly take into account the indefiniteness of the task in a convincing enough way, or in any case they are encountered not in the economic sphere, but for very narrowly specialized technical problems. But indefiniteness can be taken into account not in the model itself, but in the process of work with a deterministic model, best of all in a dialogue. Of course we have in mind an active dialogue in which the expert changes the conditions of the problem, the numerical data or even the structure of the model, and not the so-called "menu," which in certain stages offers the selection of one of the previously determined directions for continuation of the calculation. Even the simplest models of linear programming, being corresponding provided with the necessary programming environment and means of dialogue, can serve as an excellent instrument for taking into account the indefiniteness of real tasks in planning and management. But it should be emphasized that here, along with system-program and computer issues, certain problems of the methodology of economic and mathematical modeling remain unsolved.

Everyone will probably agree with V. L. Markarov when he says that it is necessary to investigate the technology of management, to describe it, to follow it, to concretize and verify execution, and so forth. But, in my opinion, one can still not hope that it will be possible to describe the technology of management clearly. Management is a creative process, although one which requires all kinds of forms of support and specializes in diverse auxiliary functions (of course, we are speaking about management of organizational and economic systems which are characterized by essential significance of the human factor). Such auxiliary functions and supporting

kinds of management activity can be formalized and automated in one volume or another, but the creative essence cannot be. Therefore it is impossible to achieve "complete clarity" when describing management technology. This circumstance must be directly taken into account when computerizing management.

I agree with those who say that at the present time there is no convincing theoretical concept of the ASU. Of course we have advanced very far during the past 10 years in the development of a technical base, system-program means, the training of planners and so forth. It is as though we have sidestepped many issues whose resolution, it seemed previously, required serious methodological results: new means of technology for processing information made it possible to solve the corresponding tasks in quite a different way so that in these cases everything came out all right and without special effort in the theoretical and methodological area. But the broader the technical and system-program capabilities, the greater the losses during their utilization because of incomplete developments in the area of methodology. In the first years of developments of ASU's two theoretical concepts were discussed: the construction of automated systems "from the model" and "from the time and motion study" but both of these turned out to be insubstantial for they did not deal with methodological problems. Nonetheless the positions which both of these approaches claimed remained unoccupied. It seems to me that practice in the best developments of has taken place quite differently--"from the demand,"and we must theoretically interpret the path that has been taken and create a concept that is oriented toward the utilization of future technical means (so far they are only plans), means of automated ties and system-program instrumentation.

Interaction With Computers in a Language That Is Close to Natural

[Kruglikov, V. I., doctor of economic sciences, professor, division chief of GlavNIIVTs of the UkrSSR Gosplan]

The past 10 years have proved that an effective ASU must have simple and convenient means for the user who is not a programmer to communicate with the computer. Computer integration from the standpoint of direct dialogue between the user and the information computer equipment should be all-encompassing and uniform in terms of the was and means of presentation of data, systematically encompassing processes of the administrative-economic management, scientific-research and experimental design work, and the preparation of production itself, that is, the modern ASU is a complex which, if necessary, includes SAPR, ASU TP, GAP, and so forth.

Microelectronics is placing the personal computer right on the desk of the economists and other specialists, thus providing the decisive prerequisites for overcoming the "psychological barrier." In order to eliminate it completely (and also improve the economic mechanism and stimulate increased production effectiveness) it is important to provide for simplicity of mastery and convenience of the utilization of computer systems. It is no accident that interaction with computers in a natural language was brought to the foreground when developing and producing computer equipment of the future, for example, of the fifth generation. The complexity of the problem makes it

possible to hope for a rapid solution with respect to machine representation of all kinds of information, although significant results have already been achieved in certain areas. With respect to quantitative data this achievement is the creation in the USSR of a principally new man-machine language which has the form of a simplified dialect of the natural language with rich capabilities of machine realization. We are speaking about the unionwide classifier of technical-economic and social indicators (OKTESP), which is approved by the USSR Gosstandart on a basis of similar GOST's as the only language mandatory for use in the USSR for intersystem exchange of quantitative data. The role and position of the OKTESP in the unified system of classification and coding (YeSKK) of technical and economic information in the USSR is determined by the fact that it solves the problem of comprehensive utilization of all classifiers of the YeSKK in the integrated presentation of indicators.

The application of the OKTESP should encompass all branches of the national economy, levels and units of management, and in the future--with the corresponding expansion--all the other branches of science and practice that utilize quantitative information. It can become the nucleus of the means of dialogue and formulation in robot equipment systems of directives and communications for feedback which contain quantitative parameters of the desired (achieved) result.

The development on the basis of the OKTESP of languages of demands for technical-economic and social indicators has provided for direct communication between the nonprogrammer and data banks under the conditions of their complete logical independence, that is, not requiring that man know any of the details (internal devices) of the ABD. There are an ABD and an SAPR for the information structure of the ASU. With the help of the departmental KTESP administrative services can project the composition, content and structure of the information supply of the ABD, assign functional tasks to sectors of the ABD which are maintained with various SUBD's, and monitor to make sure there is an abundance of noncontradictory information in existing BD's.

Thus the creation on the basis of the OKTESP of a family of software and hardware which mediates on a unified basis intellectual communication with machine systems for administrative and economic management, flexible automated production systems, SAPR's, robot systems and so forth (particularly supply of program and microprocessor OKTESP-interfaces for personal computers and SUBD's) is one of the important tasks for the future period. It can radically increase the effectiveness of the utilization of modern ASU's in the practice of economic management and the organization of production processes.

The introduction of OKTESP understood in this way requires coordination of the efforts of all branches and departments on the basis of a special target comprehensive program and its creation and implementation should include the participation of the division for information, computer equipment and automation, and the division of economics of the USSR Academy of Sciences, the USSR State Committee for Science and Technology, the USSR Gosplan and Central Statistical Administration, the Gosstandart and other ministries and departments. An important role should be played by the corresponding .pa scientific councils of the USSR Academy of Sciences and the USSR State

Committee for Science and Technology.

The ASU--A Time of Great Changes

[Gigineyshvili, L. V., candidate of technical sciences, director of the Georgian branch of the All-Union Scientific Research Institute of problems of organization and management under the USSR State Committee for Science and Technology]

During the past 10 years the development of program technical means for ASU's has surpassed the expected level. Just a list of the concepts--distributed data bank, data base administrator, microprocessors, computer personnel, VTsKP, verbal input and output for electronic computers, dialogue display stations, computer networks, artificial intelligence and others which have become firmly established in daily use--show the generally significant advancement. But this certainly does not mean that ASU developers have methods of planning that satisfy the requirements of today, not to mention tomorrow.

The approach to realizing the ASU should be essentially changed. In particular, the division of the ASU into the functional and support parts is losing its former meaning and ASU's of the organizational-economic types are being more and more closely connected with the ASU TP's. The existing stages and levels of planning, the sections of the ASU, the system of interrelations of developers and clients during planning and creation, and the performance of principally new tasks by traditional methods cannot properly provide for the appearance of effective ASU's.

The combination of the FAPR and the technology for artificial intelligence, when the user acts as a planner of his own automated workplace (ARM) guarantees successful functioning of the entire system. Then the ASU becomes "transparent," comprehensible to every user and easily restructured. The technology of artificial intelligence makes it possible to eliminate the stage of experimental operation when there is a duplication of the ASU by hand which also contains, in our opinion, the origin of the mistrust of the ASU.

In the modern stage intensive research is being done for ways of improving the economic mechanism. The ASU should not be an obstacle in this process; on the contrary, they must be used as an instrument for objective analysis, prognostication and decision making.

Such a factor as the "psychological barrier" cannot be overcome once and for all. It is "pulsing" by nature, if one may put it that way, and the height of this "barrier" depends mainly on the permanence of work with personnel not only among the users, but also among the developers of systems (since the latter also have their own "psychological barrier"). I shall give an example. in 1978-1980 in Georgia we developed and successfully introduced an ASU for harvesting the grape crop (the Rtveli ASU). Its introduction was accompanied by a complex of measures for training and instruction of personnel before the beginning of the season (business games and so forth), which contributed to overcoming the "psychological barrier." It would seem that the problem was solved, but as soon as the classes were stopped in subsequent years this

factor was again in evidence. There are many examples like this.

The authority of the ASU reached its highest point in the recent past. Indeed, the functional composition of tasks, the comprehensiveness of the approach and the expected large effect have left no doubt about success. But the weak technical base and program means, and also the support part as a whole did not make it possible to implement the majority of plans for ASU in the form in which they were conceived. Unfortunately, today the actual interests in the ASU has decreased significantly, and is at a time when we have sufficiently powerful technical and mathematical means and a technology for data processing which makes it possible to satisfy the needs of economic management. Sharp changes can be expected in the practice of the utilization of ASU's with the new generation and the new type of managers--production commanders and workers of the management staff who today are achieving general "computer literacy" in the 9th and 10th grades.

It is impossible to calculate the actual effectiveness of the ASU. As for the calculated effectiveness, it has meaning. It is an orientation point for the economic manager in searching for production reserves and improving the final results. The methods for determining the effectiveness of ASU's, obviously, require improvement, which is related to scientific and technical progress in this area, but there is apparently no critical need for a radical reworking of the methods. This is not where one should seek the reason for the weak interest of the manager in the introduction of ASU's, but in the fact that even an enterprise with a well-operating ASU, in keeping with the existing policy, in the final analysis ends up in a worse position than those which do not use ASU's. It is necessary to establish the system of material incentives for workers who, along with their basic profession, would study the principles of ASU, acquire practical work skills and improve training in this area.

Ensuring Precision of Measurement of the Effectiveness of ASU's and Computer Equipment

[Simchera, V. M., doctor of economic sciences, department chief of the All-Union Correspondence Finance-Economics Institute]

The question of what we actually measure when determining the effectiveness of an ASU is not at all simple. It seems that we are speaking both about the ASU and about automation of management as a whole, and we have in mind more the calculation of the "effect of measurement" and not the effect of those real changes which are taking place in the national economy as a result of the introduction of the ASU. The sum of the planned effect for all ASU's which are considered to be introduced could hardly show a correct picture.

The computer equipment used in them is of immense significance for providing for the effectiveness of the ASU. It is not only that the computers should be of high quality. The principle of setting prices for computers is also important. The proportional value (per conventional unit of capacity) should decrease while the capacities of the machines should increase. This will create incentives for the producer to improve the quality of the equipment he

produces. Otherwise the initial proportional effectiveness per unit of processed information is small.

When investigating the question of the effectiveness of the ASU I used methods of multifactoral analysis to study 42 factors with material from more than 200 automated systems. The analysis showed: with an increase in the size (that is, expenditures on creation) of the ASU the actual effectiveness of the functioning system decreases thus here too we see repeatedly approximately the same thing that is typical of the cost of computers when the prices for them are set incorrectly. But it is not only a matter of this. One can assume that the larger the ASU the less the exaggeration and the evaluation of their real effectiveness and the more precise the report data. This forces us to look even more critically at the information which we use when calculating the effectiveness of ASU's. It is possible that we are exaggerating the reliability of the information instead of carefully evaluating its precision and reliability. Increased substantiation of economic calculations of the effectiveness of ASU's necessarily presupposes the solution to the problem of increasing the precision of the initial information.

More Attention to Training of Personnel

[Yeremeyev, G. A., candidate of technical sciences, deputy chairman of the scientific council of the USSR State Committee for Science and Technology for the Problem of the Utilization of Optimization Tasks in the ASU]

The operation of the rapidly improving computer equipment and the development and utilization of program means as well as the planning of ASU's require the corresponding personnel, whose training is carried out mainly in the USSR Ministry of Higher and Specialized Secondary Education. But it seems that today we have not yet overcome certain shortcomings in this area. In spite of the fact that the period of a somewhat negative attitude toward ASU's has passed practically everywhere and the work for creating them is under way everywhere, there is no expansion of the training of personnel in all the specialties which have to do with the development of ASU's--programming, economic and mathematical modeling and so forth. The output of computer equipment, the creation of ASU's and the training of personnel are planned by two divisions in the USSR Gosplan and, apparently, they simply do not coordinate the indicators of the corresponding plan. The MinVUZ explains the lack of growth and sometimes the reduction in the number of graduates in these specialties by the fact that they do not have enough applications for them. And indeed in many organizations these applications are copied for 10-15 years without any changes, the corresponding workers do not check on the changes in the list of specialties, and they do not delve into the real needs of the enterprises and therefore their applications do not reflect the actual needs for specialists in the development of ASU's.

The inadequate development of a unified concept and of the theory of the ASU has negative consequences for personnel training. The more developed courses related to ASU's pertain to ASU TP's. There is a great difference in the interpretation of training programs in the VUZes. There are also training institutions where in the guise of the specialty of "economic cybernetics" they simply train programmers.

Although it has been noted in the round table discussion that the client for specific ASU's is not always clearly determined, still for each ASU there is a concrete object at which it will be introduced, and the interest in personnel for operating the ASU arises to one degree or another. But so far there are no works for creating a unified concept of personnel training for the development and operation of ASU's. The training plans are poorly balanced with respect to various disciplines, and they do not properly lay the necessary foundation of knowledge. It is necessary to impose order in this matter and provide for centralized financing, the creation of methodological materials and the use of these materials in all VUZes which train specialists in ASU's.

System Planning of ASU's

[Chernyak, Yu. I., doctor of economic sciences, division chief of the VNIPI of Economics and Control Systems of the USSR Minvodkhoz]

The increased effectiveness of ASU's, like other systems, is provided by scientific and technical progress. Each realized innovation increases the effect in a particular section, but the systemwide effect can be insignificant or it can be completely lacking if the innovation is separated and unbalanced. Thus the effect from rapid progress of computer equipment and software can be reduced "to zero" by weak and dispersed forces in the area of improving control and its information base. Every breakdown in the processes of production, transformation and supply in this case gives rise to a gigantic surplus of information which exceeds many times over the normal flow of data in a well-arranged control system.

The principal feature of system planning of ASU's is the merger into a unified process of technical and economic analysis and planning the control production (or other) process, the system of control itself, software, and the formation of tasks for automated data processing. The instrumental peculiarity of system planning are the universal graphic and matrix models which are used equally for modeling and analysis of production processes, controlling them, organizational planning of improvements in the system of control, formation of tasks for ASU's, and the development of normative organizational documentation for carrying out the processes of control under the condition of the existing ASU.

The logic of the process of system planning consists in the following.

1. A model of the controlled process is developed. It is analyzed from the standpoint of the effectiveness of organization of production, the balance of flows and their rates, and the existence of bottlenecks resulting from shortcomings in the organization of production or control. An important independent result of this stage is the plan of measures for improving the organization of production.

2. From this model they derive the functions of control in order to provide for a continuous effective production process. They are formulated as a normative model of the activity of the management staff, that is, a model of

the control system as it should be ideally for the given process. Initially it is suggested that the existing organizational structures for management be retained while their functions are regularized. At the same time one forms the necessary information base which is sufficient for decision-making and also one determines the required rates of movement and processing of data. An independent result of the second stage is the plan for the formation of the information base for control.

3. The normative model of the activity of the administrative staff is compared with the existing functional-organizational and informational structures of management in which one discovers the disagreements which lead to loss of controllability: duplication of certain functions and complete absence of others, a lack of correspondence between rights and responsibilities, a shortage or delay of information for decision-making, and computer and other difficulties. With system planning it is at this moment that one begins to investigate the existing control system as distinct from the practice in which the investigators try to draw up the plan for automation of control without knowing it properly. A comparison of the normative model with the existing control system makes it possible to discover objective shortcomings in the functional, administrative and information structures of control and to earmark a complex of measures for eliminating them, including means of automation of control. The result of the third stage is a plan for improvement of the functional and organizational structures of control which is directly realized in the form of a complex of normative documents.

Stage-by-stage development is being carried out for the ASU--statement of the problem, programming, adjustment and release for industrial use of problems on an integrated basis and according to a unified plan for the reconstruction of the control system.

System planning presupposes a new complex of interrelations of the management staff and developers of the ASU. The developers will come to the management staff with prepared concepts and proposals for improving the processes of production and control, and the staff adjusts the models they suggest and accepts or rejects their variants for improving control and automating it.

Since the work is strictly goal-directed it seems possible to reduce the time periods for the development and introduction of ASU's and to reduce expenditures. But the main result is the creation of an ASU that is directly oriented toward increasing the effectiveness of production and a high level of scientific and technical decisions.

A New Approach Is Needed for Evaluating the Effectiveness of the OASU

[Oboladze, G. V., candidate of economic sciences, director of the GIVTs of the USSR Ministry of Heavy Machine Building, scientific leader of the ASUtyazhmash]

Among the ASU's in operation in the country a special position is occupied by branch automated control systems. From 1971 through 1983 more than 270 ASU's of ministries and departments were created.*

Quite significant amounts of money have been spent on their development and introduction. It is natural that questions of the effectiveness of these systems are drawing a great deal of attention both from theoreticians and practical workers.

If one goes to the officially approved calculations of the effectiveness of OASU's, which figure in the composition of planning documentation, the situation looks quite good. According to these figures, expenditures on the creation of OASU's are recouped even more rapidly than are investments in new technical equipment as a whole.

But a number of inspections that have been conducted show that these figures have no convincing corroboration. The result of these inspections was the spreading of the idea that OASU's are ineffective, that they do not justify themselves and so forth. But what is typical is that not a single one of those who did the inspections can say what the real figures of the effect from the OASU are. What effect actually can be corroborated?

In our opinion this is not a matter of one kind of mistake or another in calculations and not a matter of departmental writeups, but a matter of the principal unsuitability of the very methods of calculating the effect from the OASU's. The existing methods which are used both by planners and inspectors do not take into account the actual functions performed by these systems.

The OASU's do not control branches. They only carry out the work for information service for the management staff of the branch--collection, accumulation, processing, storage, and issuance of information necessary for planning, analysis and regulation of the activity of associations and enterprises. These are operations necessary for control but they do not comprise its "core," its basis. The work of the OASU is service for management and the production of information services.

It is no secret that today neither economic science nor practice has precise, substantiated methods for evaluating the effectiveness of management as a whole. Obviously the improvement or deterioration of indicators of the operation of enterprises depend not only on the quality of management activity of the personnel of the ministry or VPO, but also on many other circumstances that go beyond the framework of the system "managing block--object of management." We have no procedural apparatus that makes it possible to single out from the multitude of factors the effect from improvement of management. It is even more incorrect to judge from the results of the operation of national economic objects the effectiveness of the performance of individual operations of the management cycle which is carried out within the OASU.

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* "USSR National Economy in 1983," Statistical Annual, Moscow: Finansy i statistika, 1984, p 104.

We shall give just one example from the practice of the operation of the branch system for control of heavy and transport machine building (ASUtyazhmash). The GIVTs of the Mintyazhmash has developed and introduced a complex of tasks for controlling product quality which provides the main inspection team for quality and the corresponding services of the VPO with crucial information under operational conditions concerning the kinds and causes of defective work on individual items, the reasons for complaints, the course of their consideration and satisfaction, and so forth. This complex was awarded a medal in the exhibition of the achievements of the USSR national economy but, if one were to follow the spirit and the letter of the existing methods for evaluating the effectiveness of OASU's, it would have to be removed from operation since the losses from defective work and complaints have not decreased recently in the branch (although this was brought about my a number of factors that had nothing to do with the OASU).

It is obvious that we need not partial improvements in the existing methods, but the creation of a principally different approach to evaluating the effectiveness of OASU's which would take into account their purpose--information service for the management staff both of the branch and of the national economy as a whole; and judgment should be made according to the degree to which information needs for management are satisfied and the expenditures made on this.

The changeover of associations and enterprises of a number of ministries to operation under the conditions of the economic experiment required a new interpretation of the position of the OASU in the process of management. One can hardly agree with the ideas that expansion of the independence of enterprises should entail a reduction of the volume of information that goes to the level of the VPO and ministries and, consequently, a reduction of the number of problems solved in the OASU, especially control-analytical ones, and a concentration mainly on issues of long-range planning. In our opinion, this statement of the problem is incorrect. An expansion of the rights of the enterprises means not a dying out of centralized management, but its qualitative improvement. This pertains not only to planning, but also to control and operational regulation of production and economic activity.

The solution to control and analytical problems of the OASU should be directed not toward trivial work of the enterprises, but to prompt rendering of effective assistance to them. Therefore it becomes more important to have information concerning the course of the fulfillment of planning assignments and contractual commitments. In ASUtyazhmash, for example, recently there has been a sharp increase in the number of problems of operational control of schedules for the assimilation of new kinds of products, technical reequipment of enterprises, deliveries under agreements and so forth. Without solving these it is impossible to render practical assistance to the objects that are being controlled.

But the production capacities of the computer centers engaged in the processing of information for the management staffs of branches are limited. The growth of the volumes of operational information forces us to think about the question of expedient distribution of the work among automated systems of various levels and for various purposes. Now, in particular, the OASU's

process large volumes of statistical reporting. The consolidated reports for the ministry which were formed in the OASU frequently simply duplicate the same reports that are created in the Central Statistical Administration.

Would it not be better to make the Central Statistical Administration responsible for all processing of statistical reports, having provided for the transfer from the computer center of this system of the information necessary for controlling the branch to the OASU on machine carriers? This would reduce the document flow, would lead to a reduction of the labor-intensiveness of the transfer of data from documents to machine carriers on the scale of the country and would make it possible to concentrate the resources of the OASU on planning and control-analytical problems and on the development of operational data. Such a solution to the problem would be a real embodiment of the principles of integration of the ASU.

System Integration--The Main Direction for the Development of the OASU

[Avrov, B. A., chief of the main planning and economics administration of the USSR Minradioprom]

It is possible to single out three periods that are typical for the development of many OASU's. In the first (the 1960's) attempts were made to immediately create a unified automated system for planning, accounting, control and operational management which embraced all spheres of the activity of the branch and organizational levels of management. Here one of the goals of the development was to sharply reduce the number of management personnel. But the insurmountable difficulties in the development and introduction of OASU's in such a situation thought about a changeover to a task-by-task approach, which characterizes the second period (the 1970's). With this approach the system developments are limited mainly to information and program-mathematical support for the OASU. The functional tasks of the system of management are analyzed individually, and the algorithms for their solution basically remain the same as they were before automation. The implementation of this approach made it possible to considerably relieve management personnel of the growing volume of information process which was related to solving routine problems.

The main shortcoming of the task-by-task approach is that it does not provide the necessary level of agreement or coordination of the performance of the corresponding functions by individual units of the management system from the standpoint of the activity of the branch as a unified economic and organizational system. It is not possible to realize one of the most important potential properties of the OASU--comprehensiveness and system in the development of planning and management decisions which pertain to various spheres of activity of the branch. Moreover, because of the load on the management staff mainly with functions of an operational nature, they were the ones who turned out to be the object of intensive automation. The tasks of a strategic type--retrospective analysis of the peculiarities of the development of the branch, the formation of predictions for the most important scientific and technical directions and, finally, the formation of comprehensive long-term programs for development--under the conditions of the task-by-task approach, as a rule, do not go beyond research work.

At the present time the task-by-task approach is methodologically outdated. But because of it objective prerequisites have been met for combining tasks that are carried out locally and raising the scientific and technical level of the OASU itself.

Qualitative improvement of the OASU as the controlling system is promoted, in the first place, by the work being conducted on the scale of the national economy and particularly in the branches for improving planning, the economic mechanism and increasing the effectiveness of control of branch production and, in the second place, by the appearance of new system-program means of accumulation, processing and searching for information.

From this standpoint the most promising are dialogue man-machines systems which make it possible for managers of the branch to participate directly in the formation of planning decisions and also to analyze and evaluate the consequences of their implementation, including the remote consequences.

Such systems in combination with a complex of automated workplaces (ARM's) for managers of the branch should be regarded as a new stage in the development of the OASU, which is naturally called a period of system integration (the 1980's). The most important conditions for the implementation of system integration of the OASU's can be reduced to the following.

1. It is necessary to develop for the higher level of branch management an automated complex of control and decision-making. It should have the corresponding information support so as to provide for control and analysis of the condition of production, scientific and other spheres of activity in the branch and also include economic and mathematical models that are oriented toward comprehensive technical and economic analysis of management decisions that are made and their consequences in the near and distant future.

2. For a coordinated solution to problems of planning and management at all organizational levels, which embraces or interacts with the OASU (the Gosplan--the highest management level of the branch--the main functional administrations -- the main production administrations -- associations -- enterprises), it is necessary to create an integrated information system. Such a system presupposes the organization of exchange of data among functional subsystems of the OASU and also the OASU and associated systems for planning and management. This exchange is possible only with the utilization of modern principles of "nonpaper" technology of organization, processing, search and presentation of information.

3. It is necessary to conduct a complex of organizational and technical measures that provide for practical realization of the advantages of the integrated OASU. This includes measures related to the introduction of new methods of planning and management in the branch (particularly program-target planning), improvement of the policy and procedures for forming the information base for solving functional problems of management, interaction among management agencies of the branch when jointly solving the corresponding problems, and so forth.

Improving the Automated System of State Statistics

[Belov, N. G., doctor of economic sciences, deputy chief of the USSR Central Statistical Administration]

During the time that has passed since the preceding session of the meeting of the round table an automated system of state statistics (ASGS) has been created in the USSR Central Statistical Administration. At the present time we are completing the development of its third section which will automate the processing of practically report and statistical information. And when creating the ASGS we directly utilized the experience in mechanized processing of report and statistical administration which has been accumulated in the USSR Central Statistical Administration with punchboard and keypunch equipment during the 1950's and 1960's. Because of this experience the ASGS developers did not encounter a "psychological barrier," although the changeover to qualitatively new technical equipment required a certain amount of rethinking of existing experience.

The ASGS has become a constituent part of the system of state statistics, without which it would be unthinkable to process the significant volumes necessary for planning and control of accounting and statistical information in the required time periods and with the existing number of workers.

With the development and introduction of the third section of the ASGS under the 11th Five-Year Plan the stage of the establishment of the ASGS is on the whole completed and the basis is laid for its subsequent development and improvement as a powerful information computer system on a qualitatively new technical and organizational-technological base.

The basic results achieved in this stage which determine the possibility of changing the ASGS over to this path of development are: the creation of a territorially distributed technical base equipped with modern equipment and software for realizing the progressive technology of data processing; the automation of the more labor-intensive and important statistical work, which made it possible through one-time introduction of data into the system to make it available not only for current processing and obtaining consolidated reports, but also for integration in data bases; the development, introduction and organization of automated unionwide classifiers of technical and economic information which is the informational basis for integrated processing of data and interaction with external automated systems; special program support oriented toward user statistics which offers the opportunity of convenient and prompt access to information resources of the system from terminals; the training of specialists who are capable of satisfying the needs of the ASGS, particularly its functioning, development and improvement.

In the future the ASGS should be characterized by increased analytical ability, efficiency and economy of the system and deepening of the integration of statistical information. It is planned to expand the list of problems solved on computers, to reduce the time periods for solving them, and to reduce the proportional expenditures on the processing of statistical information. In practice this means the development of work in the following areas: further improvement of the system of statistical indicators and their

reflection in new improved complexes of statistical tasks and ABD data bases; the creation of a distributed automated data bank on the basis of expansion of the network of territorial ABD's and the development of means of teleprocessing; the creation and automated maintenance of a system of classifiers of economic information; the introduction of system software as a necessary condition for increasing the flexibility and economy of problems solved in the ASGS; and extensive utilization of standard planning decisions in the ASGS.

At the present time the ASGS carries out exchange of data on machine carriers with the ASPR of the USSR Gosplan and a number of ASU's of ministries and departments. Experimental work is being done to obtain statistical reports on machine carriers directly from the enterprises and organizations. The important thing in resolving this problem is the creation of computer centers for collective youth (VTsKP) which service enterprises and organizations that do not have their own computers.

Integrated processing of information requires accelerated development of system-program means of the ASU. This is reflected not only in the development of software for the ABD, but also in the preparation of means of teleprocessing, packages of applied programs and means of automated planning. In our opinion the system means obtained from the developers of YeS and SM computers does not always correspond to the concrete conditions of the work of the computer center.

With the development of system-program means special attention should be devoted to questions of standardization of planning decisions which are oriented toward a unified interface for all branch ASU's. This direction is one of the key ones in the integration of ASU's. At the same time it is necessary to further improve the basic characteristics of computer equipment.

As the most important directions for increasing the effectiveness of the functioning of the ASGS we shall name: deepening of the analytical nature of the developed statistical indicators through the utilization of economic and mathematical methods and the acquisition of additional cross-sections for analysis of economic processes and phenomena in the national economy; the reduction of time periods for processing and presenting the necessary statistical data and the possibilities of operational preparation of analytical references; increased reliability of information as a result of improvement of methods of control and processing of statistical data; reduction of the labor-intensiveness and increased labor productivity, which makes it possible without increasing the number of workers to process the constantly growing volumes of information. We note that the existing methods of calculating the economic effectiveness of ASU's, including the ASGS, are in need of further improvement.

Concluding Word

[Academician Fedorenko, N. P., editor in chief of the magazine EKONOMIKA I MATEMATICHESKIYE METODY, chairman of the scientific council of the USSR Academy of Sciences for the comprehensive problem "Optimal Planning and Management of the National Economy"]

Our round table discussion has come to an end and it is time to sum up the results of the 2-day consideration of problems and prospects for the development of ASU's. First of all we should like to state with satisfaction that all participants without exception--both those in attendance here and those were unable to come but who sent answers to the questionnaire-recognized the timeless of this measure, the crucial nature of the issues raised for your attention and the expediency of this form of discussion. The speakers noted that the high theoretical level of the discussion, its practical direction, the spirit of cooperation and comradeship, including when opinions diverged and disputes arose regarding complicated problems which we still have to resolve. We are glad to accept the suggestion to hold round-table meetings more frequently.

Apparently we must recognize that the level of theoretical developments in the area of ASU's does not fully correspond to those technical capabilities which we now have at our disposal and should undoubtedly be increased. It is known that the initial concept of the ASU was created in the middle of the 1960's and the beginning of the 1970's. Since that time new technical means have appeared which essentially expand the functional possibilities of the ASU. I have in mind above all mini and micro computers, dialogue systems, and automated data banks which provide direct user access to information.

Thus in our opinion, there has not been adequate theoretical development of problems of integrating ASU's of various levels, particularly determining an efficient degree of integration of systems along the horizontal and vertical taking concrete conditions into account. The integration of ASU's is closely associated with the activity of the economic mechanism. Theoretical research on the interaction of these processes is also crucial. There is undoubtedly a need to improve the methods of evaluating the effectiveness of ASU's. As Professor V. V. Kossov correctly noted, in research on problems of ASU's "too much attention is being devoted to the technical aspects and not enough to thinking about the organization of information processes and revealing the essential needs of managers for information. Without this ASU will not be able to help the manager to control production."

Serious attention should be devoted to questions of organizing the introduction of developments for the utilization of computer equipment and mathematical methods in planning and management. Academician L. V. Kantorovich was undoubtedly right when he pointed out that the process of introducing ASU's must be changed over to the conditions of the economic experiment. Corresponding Member V. L. Makarov made an interesting suggestion concerning the creation of a new type of NPO which would conduct the entire cycle of work--from fundamental research to introduction "on line" with a structure of external organizational ties that is principally different from the ones used now. For successful introduction of ASU's it is important to provide as the object the kind of economic and organizational conditions whereby automated technology of control would not be severed from the existing structure of control. At the same the possibility of creating these conditions depends largely on the degree to which the ASU takes into account the specific peculiarities of the object. Academician L. V. Kantorovich correctly noted: "High-quality results are ensured only when one takes into

account the peculiarities of the concrete object or production, and specialists who are well aware of these peculiarities are enlisted for the development of the ASU." Experience has shown that one should not develop any kind of standard "normative" ASU without orientation toward the existing structure and methods of management or demand complete restructuring from the latter. In turn, the ASU should not represent an automated copy of the real management system. Here they must move toward one another. On the one hand, the ASU will introduce new tasks into the existing system of management and to a certain degree will change the technology of management. On the other, it should provide workers of the management staff with the most convenient and effective methods and means of work that are possible under the new conditions.

The success of the introduction of ASU's is determined to a considerable degree by how fully they satisfy the demands of the workers of the management staff, above all the top managers, and the degree to which the management of the object participates in the development and introduction of the ASU and how fully all aspects of the activity of the system for managing the object are encompassed. It is necessary to attentively analyze the experience in introducing ASU's at various levels of management. From this standpoint attention should be given to the statement of Professor N. B. Mironosetskiy: "The main conclusion to which the analysis of the process of automation of management leaves us is that top managers should be enlisted in the development of ASU's and their operation. Only this way is it possible to achieve comprehensiveness. The director is obliged to be concerned about all aspects of the activity of its enterprise, and if he participates in the creation of the management system, this guarantees the achievement of comprehensiveness."

This is a very appropriate time to raise the question of training of personnel: ASU developers, specialists in economic and mathematical modeling and economic cybernetics. It was also noted that there is a persistent need to train management personnel. Especially high qualifications are required when working with optimization models. It is possible to obtain the maximum effect from computerization only by satisfying the need for skilled specialists. The corresponding measures should be taken immediately because the saturation of the economy and the management system with computer equipment is increasing each year, and during those 5 years which--as a minimum--separate the decision to increase the graduation of specialists from the real increase in their number, we can underestimate the economic effect and discover a growth of the notorious "psychological barrier" because of the lack of provision of skilled personnel for this most important work.

The concept of "automated control system" has become so broad and the name ASU is now used for such diverse and dissimilar systems that, apparently, those people are right who insist on the inexpediency and even the impossibility of including all ASU's "under one name"--both with respect to the principles of planning, organization, introduction and operation and, when evaluating the expected (planned) or actual (report) effectiveness. In our opinion one should single out mainly two classes of systems for providing management of means of automation: at the level of the enterprise (traditional ASUP's) when speaking directly about management of production and interaction between

people and technical equipment, and at higher levels (ASPR's, OASU's and so forth). Correspondingly, one should single out two main directions for the development of ASU's:

at the level of the enterprise--integration of computer service for all functions of management: technological processes, preparation of production, planning, accounting, supply,, sales, personnel, bookkeeping and so forth on the basis of the utilization of a unified automated data bank for the enterprise and a unified integrated complex of technical means which includes computers, measurement and control devices, terminals for users and so forth;

at the higher levels--the creation of automated work positions for workers of the management staff and organization of automated exchange of information through communications channels along various systems along the vertical and horizontal.

For successful advancement in both of these directions it is necessary to have various measures for providing the management system with modern advanced computer equipment and improving system program support. Participants in the round table discussion made a number of suggestions regarding this (see Issue 3 of our magazine for 1985, pp 554, 555 and others). The discussion was about the priorities not only of various directions for the development of computer equipment and system-program means, but also tasks of planning and management as objects of automation and ways of integrating ASU's.

An important direction for improvement of management systems is the development of man-machine control technologies which support ASU's and more extensive utilization of these. The existing level and the tendencies in the development of information computer methods and means contribute to successful creation of man-machine systems of decision-making within the framework of the ASU's: computers whose configurations include video terminals and the corresponding means of communications; program systems for the creation, maintenance of data banks; system program complexes that maintain various languages for communication with the users, including workers of the management staff, with computer devices, data bases and applied programs, and which also provide for interaction among users, and so forth.

Man-machine technology of management, in our opinion, provides a number of advantages over traditional means.

In the first place, as a result of effective distribution of the functions between the computer and the use (management staff worker) there is greater efficiency in making management decisions. Here the computer is used for doing labor-intensive and multivariant calculations and also for preparing and forming a multitude of variants of decisions. The evaluation and selection of decisions from the given set or their adjustment taking into account nonformalized factors and also control of the work of man-machine systems through the assignment of control actions are done by the user during the process of his interaction with the computer.

In the second place, because of the integration of data, the provision of direct access to it and the possibility of extensive utilization of economic

and mathematical models, the quality of the decisions that are made improves. The provision within the framework of man-machine systems interaction with economic and mathematical models for decision-making and also the possibilities of exerting a direct influence on the results obtaining by formal methods, in our opinion, raises the degree of confidence of management personnel in these models and will contribute to the still-existing "psychological barrier."

The development and utilization of man-machine technology of control will also have a side effect--stimulating a rise of the overall level of qualifications of management personnel and their responsiveness of new methods of management.

Summing up the suggestions of participants in the round table discussion, one can make the following recommendations in this area. For a sharp increase in the effectiveness of ASU's it is considered necessary:

to change over planning, introduction, technical support and software of ASU's to a modern industrial basis through the formation of a new branch--information science--which is called upon to provide for centralized system planning of ASU's including the creation of the corresponding standards, unified, documentation, systems of man-machine communications, methodological materials and so forth;

to create new methods for evaluating the effectiveness of ASU's which take into account more fully and precisely the diverse consequences of these systems;

to develop concrete measures for increasing the motivation of economic managers to create and effectively operate ASU's, including the refinement of the corresponding economic normatives.

All these suggestions, like the discussion of the factors that bring about the still inadequate effectiveness of expenditures on computerization, which are holding back the dissemination of better economic and mathematical methods and models, undoubtedly, deserve the most attentive study and generalization. We are hoping that they will attract attention from all those who are engaged in various aspects of the introduction of computer equipment and economic and mathematical methods into management and that the materials from the discussions we have held at our round table will effectively contribute to the development of this process.

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CATALYSTS OF PROGRESS

Tbilisi ZARYA VOSTOKA in Russian 17 Dec 85 p 3

[Article by Otar Kupatadze, deputy chairman of the GSSR State Committee for Science and Technology, under the subhead, "Achievements of Science and Technology Are for All Industries."]

[Text] In the draft Basic Directions for the Economic and Social Development of the USSR for 1986-1990 and for the Period to the Year 2000, it is recognized as advantageous to organize massive output of personal computers and to increase the overall volume of computer technology production by a factor of 2 to 2.3.

Recently, a decision was adopted by GSSR directive bodies on measures to increase the effectiveness of computer technology and automated systems in the economy in the light of demands by the All-Union Conference on Problems in Accelerating Scientific and Technical Progress. Somewhat earlier, the republic Council of Ministers approved a republic program for creating, developing, and effectively utilizing automated systems and computer technology for 1986-1990. Thus, on the threshold of the 12th Five-Year Plan in our republic, there are program documents approved by directive bodies in which are formulated the basic problems of republic ministries, agencies, associations, enterprises, and organizations in the area of utilizing computer technology and automated systems that make possible the improvement in management of the economy and the solution of large-scale problems clearly posed at the fourth session of the USSR Supreme Soviet, 11th Convocation.

Significant progress in the scale and effectiveness of computer technology application has taken place in our republic during the last 10 to 15 years.

Although, earlier, at the first stage in automating the organization of management, almost all proposals in this direction met a skeptical attitude on the part of management personnel, today the picture has significantly changed. Electronic information processing services, created several years ago in ministries and agencies, primarily by directive procedure, on order from above, and referred to by various names (computer centers, information-computer centers, information-dispatch sections, and so forth), today have become a basic subdivision of the management apparatus. Active and with great benefit for business, the following are in particular users of computer technology: Gosplan, Gossnab, Central Statistical Administration, the Ministries of Finance, Automobile Transportation, the administration of the Transcaucasian Railroad, and a number of others.

The total computing capability of the machine resources of the republic today constitutes tens of millions of operations per second. The quantity of specialists occupied in all sectors of computer application has exceeded 8,000. Among these, over half have higher education.

This year, work is being completed on the creation of the first series of republic automated control/management systems (RASU-Gruziya), including the introduction of automated information processing systems for directive bodies (ASOIDO), automated inter-industry functional complexes for planning, statistics, supplies and equipment, finances, labor resources, and the development of science and technology; inter-industry complexes for management in construction, health, education, transportation, and agro-industrial production; and also the regional automated systems of the Adzhar ASSR and the cities of Tbilisi and Poti.

A system of finance accounts in dialog regime has been adopted and put into operation in the republic Ministry of Finance. Here, an automated work place for finance specialists has been created on the basis of the Iskra-226 microcomputer.

An automated system for diagnosis and process control based on the SM-4 computer has won approval in the health system in the rehabilitation division of the republic scientific center for traumatology and orthopedics.

The Ministry of Education has developed and introduced into school practice automated study and remedial courses in physics, algebra, and Russian language. This school year, general educational schools of the republic have introduced the course, "Fundamentals of Programming and Computer Technology." The republic has undertaken the first steps in introducing microprocessor computing technology in complex automation and robotization of production lines and in creating automated design systems.

At the end of 1984, according to data from the GSSR Central Statistical Administration, 51 automated systems of all types were functioning in the republic. Among these, 19 were industrial automated control systems of ministries and agencies, 17 were automated control systems of enterprises, 9 were automated control systems of technological processes, and 6 were automated information processing systems.

The question naturally arises as to how to evaluate quantitatively the automated control systems we have created against the background of national indices. First of all, it should be stressed that there is no pertinent, clear, and reliable criterion for such an evaluation. Nevertheless, the question arises and requires an answer.

If one tries to understand it with the aid of the concept of the basic industrial plant, the following picture takes shape. According to the quantity of operating automated control/management systems present in the basic industrial plant per billion rubles, the republic lags the national average by over one-half; in the USSR there are 5 automated control/management systems per billion rubles in the basic industrial plant, and in the GSSR, there are 2.3.

The situation is even worse from the point of view of functioning automated control/management systems. The proportion of automated control systems for technological processes in the total quantity of functioning automated control/management systems in our republic constitutes about 17 percent while, in the whole country, they

constitute over 40 percent. Thus, it turns out that the share of automated technological processes in the total quantity of our systems is about one-fifth or one-sixth that in the whole country. It should be taken into account here that, according to now generally accepted opinion, automated control systems for technological processes are the most effective of all types of automated control systems. The situation is no better from the point of view of the effectiveness of the functioning of automated control/management systems that have been created.

Research and analysis done by the GSSR State Committee for Science and Technology together with the GSSR Gosplan and Central Statistical Administration has revealed the unsatisfactory effectiveness of automated control/management systems in the overwhelming majority of cases. This has been caused by a number of things, often interrelated.

Analyzing the basic ones, it is not difficult to see that the created and functioning organizational automated control/management systems, under very close scrutiny, are actually not systems of control in the full sense of this word. As a rule, they are only a part of the system and accomplish important but still collateral functions in the automated collection and processing of information. Thus, many operating automated control/management systems really are automated systems for information processing, which, of course, is not at all the same thing.

First of all, this is indicated by the fact that, among problems being solved in these systems, a very small proportion involves modelling or optimizing problems. What is an optimizing problem? This is a typical control/management problem in which the goal is given, the resources are given, and it is necessary to find the control that provides for achieving the goal with minimal expenditures of resources. In control theory, it has been shown that any control problem can be reduced to an optimization problem. In practice, any optimization problem has such large dimensions that its solution by hand is completely impossible. For this, a computer is needed and a corresponding program is needed. And for this, automated control systems are created. However, in the automated control/management systems that have been created, there are practically no optimization problems. The basic reason for this is the almost total absence in the routine practiced by our economic managers, especially low level managers, of any necessity for solving economic or administrative problems. As a rule, in this situation, they behave like administrators, striving with all their effort to fulfill the production plan that comes down from above and not like zealous masters or managers interested in reaching an established goal with minimal expenditures.

Meanwhile, a modern enterprise furnished with modern means for planning and management, can carry out its production-management activity at a qualitatively different level from that permitted by the management practice that has evolved, the profound restructuring of which has been stressed in party documents and in speeches by the General Secretary of the CPSU Central Committee, M. S. Gorbachev, and in the decisions of the fourth session of the USSR Supreme Soviet, 11th Convocation.

The lack of correspondence between the potential capabilities of modern tnterprises to carry out their production functions and management practice is one manifestation of lack of correspondence between the contemporary level of development of production forces and the character of production relationships.

resources for their accomplishment in the designated periods and planned volumes. In the process of solving the problem, there is the question of creating a unified scientific-academic-industrial center for complex centralized computer service and for the maintenance of a republic library of algorithms and programs.

Recently, work on the broad and effective use of computers in our republic has become more active. This, first of all, has been made possible by the activity of the section on robotization and automated systems of the Republic Coordinating Council on Science and Scientific and Technical Progress. It was this section whose initiative led to the organization recently at the GSSR Exhibition of Economic Achievements, two thematic exhibits: "Industrial Projects and Robotized Technological Complexes" and "Personal Computers in Professional Activities and in Instruction."

As we see, the era of computers has come. They penetrate all spheres of man's intellectual activity, and this process inevitably gives rise to its own complicated problems and dictates its own demands, which are necessary to solve now in a complex fashion and according to what is best for the state.

9645
CSO: 1863/129

AUTOMATION -- THE COMMAND OF TIME

Riga SOVETSKAYA LATVIYA in Russian 23 Jan 86 p 2

[Article by E. Krukovskiy, general director of the Riga scientific production association, Tekhnopribor, and honored worker of LaSSR industry, under the rubric, "27th CPSU Congress: Party Counsel with the People; We Discuss Pre-Congress Documents."]

[Text] A situation has now arisen in the economy, where the creation of new technology is retarded not by the absence of scientific ideas and engineering solutions, but by long design periods and sometimes unsatisfactory quality in design and technological development of innovations. It can be stated that, for the present, there is a noticeable break in the growth of labor productivity in the production sphere and in design. Life insistently requires the elimination of the lag by designers, and there is an effective means for solving this problem. This is the introduction of automated design systems.

Already, today, modern microprocessor technology provides the possibility for creating automated design systems which sharply reduce labor content and the time required for design and technological work and are thus making possible the acceleration of scientific and technical progress.

Until recently, general purpose computers were the basis for automated design systems. In recent years, automated work places using minicomputer and microprocessor technology have been applied more often for technical implementation of automated design systems. They can work both in an autonomous regime and in a computer network, providing solutions to problems of automating the design of production preparations at all levels.

Systems of automated design are being increasingly applied to the development of technological processes, the design of equipment and tools, the preparation of controlling programs for machine tools with numerical program control, the accounting and standardization for materials and component manufactured items, and the introduction of changes in operative documentation.

Work on the development and introduction of automated design systems is also conducted by the Central Planning and Design Bureau for Mechanization and Automation, which has recently become the head organization for the Riga production association, Tekhnopribor. Here was created the dialog system for automated preparation of

controlling programs for machine tools with numerical program control, which has proven itself in industry. The system is oriented toward the use of SM-4, SM-1420, and Elektronika 100-25 minicomputers and permits automated preparation of controlling programs for electro-erosion, milling, turning, and drilling machine tools with numerical program control, and obtaining charts for calculation of coordinates and angles for the preparation of details for coordinate-hollowing-out units.

Such systems, developed at Riga, are already in use at 40 enterprises in the country. The economic effect from their introduction has exceeded 2.5 million rubles.

Our specialists have developed an even more complicated system which permits the composition of programs for three-dimensional machining of components. Such a problem previously was not within the capability of every programmer. But now, an automated design system can work out a controlling program in 15-20 minutes.

The Avtoshtamp separating punch system, developed by the Central Planning and Design Bureau for Mechanization and Automation together with specialists from Moscow and Kiev, has attained widespread distribution in the country. In it, it is enough to put in a drawing of a component for which it is necessary to design and fabricate the punch. And then the system itself accomplishes the design for the technology for punching the components, the calculation of optimal cutting of the material, the design of the punch with the preparation of working drawings in detail, the standardization of all operations of the technological process, and the formation of controlling programs for the fabrication of these components on machine tools with numerical program control. A whole set of technical documentation and controlling programs for a machine tool with numerical program control is worked out in 6-7 hours. This means that design time is reduced to one-tenth of what it was previously, and the whole cycle of preparing sheet-stamping production to one-half to one-third of what it was previously. The economic effect from introducing the Avtoshtamp system at enterprises of the country has already reached five million rubles.

Now, we have organized the Center for Automated Design of Technological Equipment for enterprises of the Baltic region, based on the Avtoshtamp system. Together with colleagues we are also developing automated design systems for other types of technological equipment, including such complicated equipment as die-casting molds for casting components from thermoplastics and nonferrous metals.

Specialists from our scientific production association, Tekhnopribor, are actively conducting work on the automation of all basic components of tool production.

The results obtained from and the comments of production workers on automated design systems are gladdening. But the economic effect from their use nevertheless is less than our expectations. The problem is that the problem of unifying hardware and software developed by different branches of industry has still not been solved in the needed fashion. Developers' lack of access to all systems of computer technology hinders the introduction of automated systems. In addition, enterprises do not have a satisfactorily high level of organizational work on the introduction and operation of automated design systems.

Similar shortcomings are especially felt today, when the party insistently demands a sharp acceleration in scientific and technical progress. This demand runs through all pre-Congress documents. In solving this problem, the role of design automation

cannot be overestimated. It permits not only the introduction of new technology, but also the creation of flexible automated production.

I think that it will also be completely correct to stress design automation in the Basic Directions for Economic and Social Development of the Country. Therefore, I propose that the section of the draft Basic Directions which speaks of accelerating scientific and technical progress and the development of science, after the words, "To raise the level of production automation by a factor of approximately 2," include the words, " . . . and design automation by a factor of 3 to 4." This will force executives and specialists to pay more attention to the important direction of accelerating technical progress.

9645
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AUTOMATED PRODUCTION PROCESS MANAGEMENT SYSTEMS

Moscow EKONOMICHESKAYA GAZETA in Russian No 4, Jan 86 p 14

[Article by Professor V. A. Myasnikov, chief of Main Administration of Computer Technology and Control Systems, State Committee for Science and Technology]

[Text] Automated production process management systems (ASU TP) have begun to be designed and developed on the basis of computers since the 1960's. The nunmber of ASU TP in the national economy is doubling each five-year period and reached 4,700 by the end of 1985.

Production processes, as is known, are complicated and assemblies are made ever more powerful. Energy blocks with capacity of 1,000-1,500 megawatts each operate at nuclear power plants, one oil pre-refining plant is capable of handling up to 6 million tons of raw material per year and flexible-rearrangeable production systems are being developed in machine building. Man is incapable of following the operation of these complexes. ASU TP comes to his aid.

There are numerous sensor instruments that measure the parameters of the process (for example, the temperature and thickness of the sheet metal to be rolled), that check the condition of equipment (temperature of turbine bearings) or that determine the composition of the initial materials and of the finished product in ASU TP. There can be several tens to several thousand of these instruments in a single system.

The sensors continuously emit signals that change according to the parameters to be measured (analog signals) to the object communication device (USO), the computer. The signals are converted in the object communication device to digital form and are then processed by the computer according to a specific program.

The computer compares the information received from the sensors to given operating results of the unit and emits control signals which are fed to the regulating members of the assembly through another part of the object communication device. For example, if the sensors emit a signal that a sheet is emerging thicker than scheduled from the rolling mill, the computer calculates what distance the rollers should be shifted and delivers the corresponding signal to the actuating mechanism, which also moves the rollers by the required distance.

Systems in which the course of a process is managed without human interference are called automatic. However, when the precise laws of control are known, man must take determination of control signals on himself. These systems are called automated. In this case the computer presents all the necessary information to the operator through displays--television-type devices, on the screens of which the data are illuminated in the form of numbers or diagrams that characterize the course of the process. Process flow diagrams of the object with indication of the condition of its parts can also be represented. Moreover, the computer "suggests" possible solutions to the operator.

The more complicated the control object, the more productive and more reliable the computer is required for ASU TP. To avoid the ever increasing build-up of computer capacity, systems have begun to be designed on the hierarchical principle. Several relatively autonomous assemblies are contained in a complicated production complex. For example, the energy block of a thermoelectric power plant contains a boiler, turbine and electric generator. A local control system, usually automatic, based on microprocessor technology, is created for each constituent part in the hierarchical system. For all parts to operate as a unit whole, the operation of local systems must now be coordinated. To do this, a small computer from the SM family is required.

Promising ASU TP, pilot models of which were developed during the 11th Five-Year Plan and which will be used extensively in 1986-1990, have a number of characteristic features. These are primarily automatic systems that control the operating conditions and also startup and shutdown of equipment. Optimization of control of the course of the process is provided according to selected criteria. Those parameters can be assigned in which the cost of the product will be minimal or if necessary the assembly will be adjusted for maximum performance, without assuming some increase of raw material and energy consumption per unit product. The systems should be adaptive, that is, they should make corrections into the course of the process with variation of the characteristics of materials or the condition of equipment.

One of the most important properties of ASU TP is the provision of trouble-free operation of a complex production system. To do this, the capability of equipment diagnosis is embedded in ASU TP. Based on readings of sensors, the system determines the current condition of assemblies and the tendency toward emergency situations so as to issue a command if necessary to facilitate operating conditions or for a complete shutdown. Data are presented to the operator about the nature and location of emergency sections.

The best use of resources and an increase of labor productivity are provided through ASU TP. Here are several examples.

An ASU TP for aluminum electrolysis permits conservation of approximately 250 kilowatt hours of electricity for each ton of smelted metal.

Flexible production systems (GPS), which consist of machine tools with numerical program control, automated transport and warehousing systems, controlled by a computer, yield a great saving in machine building. Design and development of a flexible shop production system at the Dnepropetrovsk Electric Locomotive Building Plant permitted a 3.3-fold increase of labor productivity, release of 83 persons and a reduction of machine tool stock by 53 units.

The average capital investments expended on design and development of ASU TP are recouped within approximately 1.5 years. It should be noted that the number of operations on design and development of ASU TP is rather extensive and monitoring its course requires constant attention on the part of the manager of the enterprise at which the system will be introduced.

New complex production processes, assemblies and plants should be designed by using automated production process management systems. In the given case, ASU TP are a production engineering product, are included at makeup articles in automated production complexes (ATK) and are delivered according to the specifications for a given type of product.

Design and development of ASU TP includes a wide range of various operations: development of the system, design of specialized instruments and automatic devices, design of computer rooms, rooms for training of maintenance personnel and operator-technicians, makeup of hardware, installation and adjustment of the system and turning it over for operation. All these operations should be clearly coordinated by a unified graph-schedule.

6521
CSO: 1863/170

EXPERT SYSTEMS

Riga NAUKA I TEKHNIKA in Russian No 1, Jan 86 pp 16-17

[Article by Oyar Krumberg, Senior Instructor in the Department of Automated Control Systems of Rizhskiy Polytechnical Institute imeni A.Ya. Pel'she, "Expert Systems;" first paragraph is a boldface excerpt from article]

[Text] "In contemporary, highly developed society, it is becoming more and more difficult to maintain and disseminate knowledge: economic ties and technological objects are becoming more complex, and the demand for information is growing sharply. Thus the knowledge industry was born."

"The old, grey, donkey sometimes sadly thought: 'Why?', and sometimes: 'For what reason?', and sometimes he even thought: 'What should one now conclude?'. And it is no wonder that at times he wholly ceased to understand what he himself was thinking about." (From the thoughts of Ia-Ia) A. Milne.

One may dare to assert that each of us at some time or another has been in the fictional situation described by A. Milne. This occurs when the necessity arises of taking some sort of important decision in one's professional activity or personal life. The adoption of wise, justified decisions in complex conditions demands hundreds of abstract thought operations. Further, over the years a specialist accumulates information in memory in the form of facts and rules. He also accumulates methods of problem-solving which have been discovered, in the form of algorithims which use facts and rules. But we know very well that in spite of experience, people are not insured against mistakes.

Usually, in order to estimate the amount of knowledge needed by a specialist and the cost of professional mistakes, medicine is examined (see, for example, NAUKA I TEKHNIKA 1984 No. 9; 1985, No. 3). Consider only these figures: information on the diseases of internal organs alone occupies approximately 2000 pages, and contains 200,000 facts. And it is said that doctors in practice use so many more facts that are not recorded in books. Besides this, about 100,000 facts describe the influence on the patient of the exterior environment (age, weather, the seasons and so on). And after all, there are ten more specialized divisions of knowledge in the field of medicine. And even if we introduce a supplemental "coefficient of safety" we still come up with approximately 2,000,000 facts! To know them, and to be able to recall and use them--all this lies entirely on

the conscience of the doctor. Analogous situations can be found in geology, in jurisprudence, in the administration of complex technical (energy networks, atomic industry) and economic (branches, regions) systems, and to a certain extent in objects of a lower order as well. Of course, we are not discussing those situations in which one is supposed to flip a coin in making a decision.

But we also know that today the computer has come to man's aid. It is now not a problem to store 2,000,000 facts with technical media. The problem is rather: how to raise the effectiveness with which computing technology is used, having created knowledge bases in computer memory and having altered the technology of solving creative problems. A knowledge base differs from well-known data bases in that storage in it is subject not only to data of one type, but also relationships. Methods of processing information here are also much more complex.

The development of the theory of artificial intelligence in the past twenty years has led to the appearance of applied areas--robotics and intelligent man-machine systems. Expert systems, which as specialists correctly think, open staggering new perspectives on the use of computing technology, belong to the second field. Expert systems (ES) are understood to include applied intelligent systems which represent knowledge in computer memory that is oriented to concrete problems. These systems mechanize all the modes of operation of their user (as teacher, pupil, and competent user--the client) and include a base of knowledge, a system for managing the knowledge base, modules of knowlege accumulation, and modules of deduction, explanation, planning and design.

Currently, scholars in many countries are developing ES theory, and are creating experimental and commercial ES's. About 100 experimental systems are described in world literature.

An expert is an individual or group of individuals capable of shaping general opinion. The expert "supplies" knowledge to the systems engineer, who knows the structure of the ES and methods of representing knowledge on the ES. Expert knowledge is often "prose fragments," containing rules of the type "if...then", "if...then /often/...", "if...then with /high probability/...", and "...is...--is /practically/ true", and so on. Since the continuation notations may hide rather long pronouncements containing both numbers and linguistic modifiers such as large, medium, and rare, as well as indefinite concepts--for example "loud noise", "green fruit", the knowledge in the computer is stored in special logical structures and processed with complex methods, which have been given the name "knowledge engineering."

And if a person quickly forgets truths which have become obsolete, when convinced of changes in objective reality (this happens as though it were automatic), the computer does not forget anything! Therefore the expert system is subject to "revision" from time to time with the aid of expert-verifiers. They may be specialists called in from outside, but the expert himself can also play this role. However, even from the point of view of the user it is desirable that the ES be supplemented constantly with "fresh" knowledge which has been critically verified.

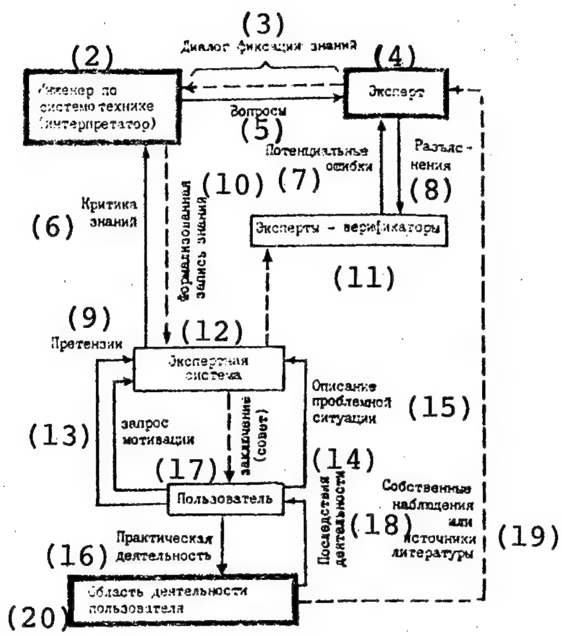
The expert system may be stored in the memory of a large computer and accessed by the user at the workplace with the aid of a display, which is connected to the computer through a telephone network or a special cable. But judging by the way technology is developing, in five to ten years it may be possible to store a large ES on a personal computer as well.

The user (a planner, administrator, engineer, doctor, or manager, and in the future, probably, a teacher or psychologist, and so on, sets forth the nature of the problem which has arisen in his professional language, entering information into the system (at the direction of the machine) with the aid of the display. But--with the benevolent cooperation of the computer! After all there are programs which are capable of replying with a sharp "cry" to a person's mistakes. The ES expresses its opinion regarding the expedient actions of the user in the form of advice. For example, the ES might present a doctor with the following table:
Diagnosis A--18 per cent probability;
Diagnosis B--70 per cent probability;
Simulant--12 per cent probability.
Along with this the ES suggests several variants of a plan of further actions, designating their relative importance. The user himself must decide to treat either illness A or B in one of the suggested ways.

In order to reach a conclusion, the ES may use thousands of the most diverse judgments, so that (due to the unreliability of memory) in the stressful moment of choice the result may seem suspect to the user and even the expert himself. Therefore, it is possible to ask: "Why?"--and the ES diligently lays out the course of its reasoning.

Implementing his final decision, the user observes the consequences of his activity and simultaneously learns. If he sees that the conclusion of the ES does not correspond to an altered real situation, he can call into question the separate fragments of knowledge stored in the ES.

Принципы работы экспертной системы
(1)



— вторичная информация (21)
— знания (22)

Key:

1. Principles of Operation of the Expert System
2. Systems Engineer (Interpreter)
3. Dialogue for Recording Knowledge
4. Expert
5. Questions
6. Criticism of Knowledge
7. Potential Mistakes
8. Explanations
9. Claims
10. Formalized Record of Knowledge
11. Experts-Verifiers
12. Expert System
13. Request for Explanation
14. Conclusion (Advice)
15. Description of the Problem Situation
16. Practical Activity
17. User
18. Consequences of Actions
19. Personal Observation or Literary Sources
20. User's Field of Activity
21. Secondary Information
22. Knowledge

Various interactive systems to facilitate decisions have been developed in the Automated Control Systems Department of Rizhskiy Polytechnical Institute imeni A.Ya. Pel'she. Their purpose is to model the subjective choice of one of the variants of possible actions, as a result of which the computer gives a "prompt." Systems of the given type work on the basis of information about the "tastes" (system preferences) of the user, for example his attitude towards risk (just as to the category of uncertainty). The computer elicits this attitude for itself, demonstrating simple situations on the display to the person, and receiving answers from him. The systems currently circulated for scientific organizations and enterprises also take into consideration vagueness expressed by the user and may work without the attention of outside experts. However, decision support systems have been consulted in a situation where, in his view, the user possisses all necessary information, and the computer only helps him to sort out his own preferences--after all, the set of criteria to be considered as well as alternative actions may be quite numerous.

Expert systems are the next step in the automation of intellectual labor. But a whole range of problems is connected with their development. And first of all, there is the construction of knowledge bases, including declarative knowledge (facts and rules), which is connected with the problem area of the ES; procedural knowledge, which describes methods of logical deduction; and general knowledge, which is concerned with considerations of common sense and with information about the exterior environment. There are three main methods of presenting knowledge on the machine: production systems, frames, and semantic networks. In the first instance, the knowledge is stored in a set of rules of the "if...then..." type. A frame is a special structure with the aid of which concepts are "divided" into parts. In turn, lower level concepts go into these parts. They describe the link between the elements and the levels found. For example, the complex internal structure of "special cases" corresponds to the concepts of "polytechnical institute" or, let us say, "airplane." Semantic networks may be seen as practically a union of frames.

Towards the goal of drawing conclusions, a large set of diverse logic has been created. Recently, probabilistic and indefinite logic have been used more and more often. The latter is based on the theory of indefinite sets and is intended for describing the meaning of words and drawing rough conclusions. Here is a typical problem which a doctor might pose for an expert system:

Rule: if a patient OFTEN has headaches and manifests symptoms X,Y, and Z, then it is likely (45 per cent) that diagnosis MODERATE A is applicable.

Input data: Sergey R. SOMETIMES has headaches and manifests symptoms X,Y, and Z.

Problem: What can be said about the likelihood of illness A and its intensiveness?

Indefinite logic gives a classical answer to this question--nothing.

Practical use of the ES shows that as rules grow older, and as a result of mistakes and disagreements among experts, informational "debris" is accumulating in the knowledge base. Therefore blocks for automatically detecting conflicts and editing rules and laws play a great role in the ES.

The use of the ES in such varied fields as automated design, medicine, antiseismic protection of buildings, computer error diagnostics, processing encyclopedic knowledge, aid in investing financial resources, molecular biology, chemistry, preparing prognoses for grain afflicted with pests, interpretation of the characteristics of oil wells, and so on, shows that knowledge engineering is effective in areas where specialists' activity is based on heuristic, informal procedures (when the person's activity cannot be described with traditional mathematical methods), and where it would be difficult or tiresome for the user to recall and interpret essential information.

In connection with this, theorists in the USSR and abroad are successfully solving the problems of artificial intelligence. One of these consists of developing special languages to process knowledge in the computer and logic for its operation. The other problem is in the creation of an "intellectual interface" (an interaction of man and machine), allowing the user to pose the problem of a synthesis of new computer programs in his own professional jargon. This means that the computer itself makes up the program according to which it will have to work! The third problem is the use of natural language for the interaction of man and machine. And finally, there are the problems of developing artificial eyesight and hearing, speech systhesis systems, three-dimensional movement, and methods of formalizing such elements of conduct as emotionally tinted actions.

Difficulties in the use of expert systems may appear when it is necessary to renew the knowledge bases constantly, or in the event of disagreement among the experts themselves. It is true that difficulties with the broad dissemination of the ES may also arise because for the present, far from all users know how to handle the computer. However, a broad program for liquidating computer illiteracy is currently being set forth in the USSR. And more than this. Even now elements of artifical intelligence, expert systems, knowledge bases, data bases and other sets of

contemporary knowledge are included in the systems engineer training program of the Automated Control Systems Department of RPI imeni A.Ya. Pel'she. Development of tactile displays is also being conducted: for an answer to a question one need only touch the appropriate place on the screen with a finger. And this removes many barriers to working with displays. But psychological problems may appear with the legal implementation of ES decisions, and also in the event that experts and users feel themselves "superfluous" in the presence of the mighty ES.

Biography of Author--OYAR ARNOL'DOVICH KRUMBERG (born in 1951 in Liepay) is a Senior Instructor in the Automated Control Systems Department of RPI imeni A.Ya. Pel'she. He is a graduate of MVTU imeni Bauman, and his candidate dissertation (1982) was connected with the automation of decision analysis on the computer. He is the author of 30 scientific publications, and coauthor of the monograph "Decision-Making Models Based on a Linguistic Variable."

13017
CSO: 1863/172

USER AND COMPUTER

Moscow VESTNIK STATISTIKI in Russian No 12, Dec 85 pp 35-41

[Article by N. Gorelik, candidate of technical sciences, State Planning and Design Institute of Marine Transportation]

[Abstract] In order to eliminate the existing confusion about the use of computers, specifically programmable small personal ones, it is helpful to define the users. Experience has shown that there are loosely three kinds of users acting in different roles. The first kind of user is a "pure" one, seeking to obtain needed results by simple and easily memorized actions. The second kind of user is an engineer, a professional person, designing the program necessary for solution of a problem by telling the computer the problem parameters. The third kind of user is a rather arbitrary one, who knows the principles of computer operation as well as the output language and at least one programming language, able to program a not very difficult algorithm without help, and able to correct errors. The main problem in the user-computer relation is that of communication, equally important to all users. This is reflected in the method of interfacing and in the interaction language, a language separate from the programming language. For users of the second kind, most numerous of all and closest to the status of mass users, the software should be based on the principle of parametrization so as to be most acceptable to actual as well as potential users and the interaction language should be special, most preferably for "question-answer" dialog mode of operation, so as to cover all possible objects and functions. Users of the first kind do not require an elaborate software, inasmuch as the number of objects and functions interesting them is quite limited, while a general-purpose software is satisfactory for users of the third kind. How software can be adjusted to suit each kind of user is demonstrated by the ASIOD automatic system of integrated data processing for the "Iskra-226" computer. References 1: Russian.

2415/9835
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AUTOMATION OF STRUCTURAL-LOGICAL ANALYSIS PROCEDURES IN PRODUCTION CONTROL

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 6, Nov-Dec 85 (manuscript received 8 Aug 84; after revision 9 Jul 85) pp 10-13

[Article by V. V. Shkurva, P. Ya. Kalita, V. I. Shishlov]

[Abstract] The essence of structural-logical analysis of information obtained during the course of manufacture concerning deviations in product characteristics from assigned characteristics is sequential. Performance of a predefined set of technological operations allows reverse transformation of data on product defects in order to recognize causes, identify production errors and the guilty parties and develop the proper corrective actions. This article studies the task of automating SL analysis procedures from the standard of planning a virtual program-controlled complex allowing a nonprofessional user to determine the source of destabilization of a production process in the interactive mode. The SL machine is described at the conceptual level. The intention is production of a computer system to perform structural-logical analysis automatically. The approach is now being implemented as a part of the automated management system of the Pinsk fabric plant imeni the 60th anniversary of the Great October. References 5: Russian.

6508/9835
CSO: 1863/134

ALONG PATHS TO TECHNICAL PROGRESS: WE ARE BUYING INFORMATION

Moscow TRUD in Russian 15 Dec 85 p 2

[Article by Ye. Druzhinina, Leningrad]

[Abstract] For the purpose of facilitating dissemination of scientific and technical information, the Leningrad Institute of Information and Automation at the USSR Academy of Sciences has developed, built, and installed the "Northwestern" regional computer subnetwork. Users of this collective-use facility range from engineers to academicians, who now have access to all libraries and databases under management of the Leningrad Information Center. With a computer terminal and display at disposal, the user does not have to purchase the source of information and shelve it or have to travel through the city as far as the Vasilevskiy Island perhaps in search for it. The subnetwork is operated on a commercial basis. The user having to pay for the service. The operation of this subnetwork saves the Center approximately 17 million rubles annually by replacing 3000 librarians regionwide as a target figure. The next step will be expending this concept to a computer network for nationwide dissemination of information.

2415/9835
CSO: 1863/131

COMMUNICATING WITH COMPUTERS

Moscow KOMSOMOLSKAYA PRAVDA in Russian 4 Jan 86 p 3

[Article: "Conversation With a Computer"]

[Text] 2 January, Thursday. The next course of the new textbook "Fundamentals of Informatics and Computer Technology" is being prepared for publication at Izdatelstvo "Prosveshcheniye."

The first part of the course has already been published. It was designed for exercises with 10th graders and students of the first courses of PTU [vocational-technical school] and technical schools. A display is depicted on the cover alongside the name of the textbook. We see an unusual inscription on the first page: "Experimental textbook." This refinement was not accidental. After all, this textbook has never existed in a general educational and vocational school. Therefore, the authors had to begin from the start.

"A special program of the new course was initially worked out," says the senior scientific editor of the editorial board of mathematics of Izdatelstvo "Prosveshcheniye" T. A. Burmistrov. "The textbook was then created on its basis. Articles were sent to our editorial board from specialists. We discuss them at different levels. Of course, there were arguments: each phrase was defined precisely and each paragraph was checked. Work on the textbook proceeded in an atmosphere of a creative search. We completed preparation and publication of the first part within 3 months."

It included two sections: "Algorithms. Algorithmic language" and "Synthesis of algorithms for problem-solving." The complexity of the new course is felt even in the titles of the sections. And nevertheless, its program was constructed with regard to the knowledge acquired by students in previous classes. The authors attempted to arrange the materials in a definite sequence, which would correspond to the well known formula--from the simple to the complex. Initial data about the computer and about machine language are given in the introduction. It turns out that the ordinary word "mama" appears in the form of 32 ciphers, arranged in a specific sequence, in computer language. And the "number" 1985 consists of 16 ciphers and looks as follows: 0000 0111 1100 0001.

"We and the authors of the new textbook are now waiting the responses of instructors about the textbook," says the editor in chief of the mathematics editorial board of Izdatelstvo "Prosveshcheniye" Candidate of Pedagogical Sciences R. A.

Khabib. "After all, they are the chief judges fo the textbook. It is understandable that specific difficulties are waiting for them. To facilitate teaching of a new course, we published an instructors manual for the teachers: 'Study of the fundamentals of informatics and computer technology.' We hope that it will be of good assistance."

The new textbook will be improved constantly. Specialists together with the instructors will find optimal versions of teaching the materials. But this will occur gradually. Izdatelstvo "Prosveshcheniye" is now preparing the second part of the textbook for publication. It is intended for 10th graders and second courses of technical schools and vocational-technical schools. The layout and operating principle of computers is discussed in it. Programming occupies a large section. The student will become familiar with the prospects of using computers in the national economy. Other literature related to this topic will be prepared for the students. Thus, the book "The student and calculations with the hand calculator." Other publications will soon appear: "The hand calculator for the student" and "How a computer operates."

6521
CSO: 1863/170

COMPUTER COURSE BEGINS IN PROFESSIONAL-TECHNICAL SCHOOL SYSTEM

Riga SOVETSKAYA LATVIYA in Russian 19 Oct 85 p 2

[Article by L. Timofeyeva: "Toward School Reform -- Computer Technology in Professional-Technical Schools"]

[Text] A new course, the Basics of Information and Computer Technology, has been introduced into the professional and technical educational system this year. It took a lot of effort for PTU [professional-technical school] instructors and students to master the novelty of programming and it is therefore very important to utilize the experience that the republic has accumulated.

Personnel in Riga SPTU-7 [Agricultural professional-technical school] are devoting a lot of attention to teaching the new profession. Two one-year groups composed of secondary school graduates have already completed their training at this school. These people have become trouble shooters for machine tools with numerical controls and manipulators. And starting this year young people who have completed the eighth grade have set out to learn this specialty. In three years they must completely master the new equipment.

Since the school trains working cadres primarily for the flagman of the republic's electronics industry, the VEF [Riga Order of Lenin State Electronics Factory, Valsts Elektrotechniska Fabrika] imeni V. I. Lenin Industrial Association, this basic enterprise is also concerned with developing a special 30-position work equipment study center. This project was developed by a department of NOT [Scientific Organization of Labor] and 150,000 rubles were spent on equipment.

Last year a special section of equipment with numerical controls appeared here and this allowed the program method to be taught right at the operating equipment. The task of starting to training participants in future work professions associated with servicing flexible automated production modules has also been assigned now.

In addition to conducting full-time mass training in labor professions, for the first time this year the school has opened a night school to retrain specialists without taking them out of production. Approximately 450 students

are involved in this program and they have the opportunity of getting experience in working with modern equipment here. One of the training goals is mastery of computer equipment.

School director M. Kanepeys stated, "We are still lagging behind the needs of a modern electronic industry as far as the level of specialist knowledge is concerned. Our task is to eliminate this gap. This is why we are persistently trying to introduce the newest equipment into the training process. It is felt that the school's technical equipment level also plays an important role in its student entrance process. This year for the first time we held competition for admissions to the school and there were 1.6 students per position."

It is not only important to acquire and emplace this expensive equipment, but also to carefully use it and find qualified specialists, masters and instructors who are able to train future industrial workers at a high scientific and technical level. The school also gives this issue a lot of attention, as much attention as it gives to improving teaching methodology. Cooperation with the university helps. There is a plan to use Riga Polytechnical Institute laboratories for workers who are studying at the school's night session. These laboratories can be used to set up activities according to tool production specialties.

A. Skueniyeks, an information and computer equipment instructor, says, "It is impossible to develop any sector of industry today without computers. And this means that it is senseless to train workers without teaching them computers. We began preparing for the introduction of the new subject, Information and Computer Technology, well in advance. VEF helped us acquire micro-calculators and in the future we will also have micro-computers. We will set up a training hall and select the necessary visual and technical manuals. We also plan to develop a display classroom in the school."

The experience of SPTU-7 will help other schools in the republic's professional and technical educational system begin the work of training workers in new specialties that were born of scientific and technical progress.

12511
CSO: 1863/115

EDUCATORS VIEW SCOPE, PROSPECTS FOR COMPUTER LITERACY IN LATVIA

Riga PADOMJU JAUNATNE in Latvian 27 Sep 85 p 2

[Report of meeting compiled by Baldurs Apinis: "Information, Technology--Questions and Answers"]

[Text] On 20 September of this year a "round table" discussion took place in the dean's office of the Physics and Mathematics Department of the Latvian State University. The participants jointly attempted to outline the range of problems associated with the teaching, clarification and propaganda of the basics of information and computer technology. Participants in the discussion attempted, even if only in the form of proposals, to find a way to solve these problems and shared already acquired information and experience. Gathered were: ANDRIS BROKS--Latvian State University, dean of the Physics and Mathematics Faculty; MODRIS EGLAJS--LSU head of the Computer Center School Information Laboratory; ULDIS GRINFELDS--senior scientific editor of the physics, mathematics and chemistry literature editorial office of the Zvaigzne Publishers, senior lecturer at LSU; EVALDS IKAUNIEKS--head of the Discrete Mathematics and Programmers Chair, LSU; JURIJS KUZMINS--chief, Solid Physics Institute, Programmers Department, LSU; NIKOLAJS USTINOVS--director of the Computer Center, LSU.

Seated at the "round table" were also the correspondents of the newspaper PADOMJU JAUNATNE, Baldurs Apinis and Peter Bankovskis, and freelance newspaper writer, Ruth Bokans.

J. KUZMINS: I think it is imperative to emphasize, at the beginning of this discussion, that before us is a whole complex of problems--so many that it would not be possible to solve them all.

Take, for instance, the idea of the general liquidation of the so-called computer analphabetism. How to understnd, in this case, the concept--liquidate ignorance.

This way is offered: teach one and all to program, in basic pascal or some other language. Then there are adherents to other variants. In their opinion everyone should be taught simply to "press buttons".

R. BOKANS: To operate machines...

J. KUZMINS: No, not just to operate but, as I already said--press keys and only that. Insert elementary information and play with this system. According to this view, each school would need an individual personal computer in order to become acquainted with it.

B. APINIS: It would seem that this playing alone would not be sufficient...

J. KUZMINS: Exactly! But more than once have I spoken to teachers who say--If we do not have the machine itself, then there is no use to even start teaching computer information.

B. APINIS: Could it be that they are right?

J. KUZMINS: Not at all! That is why a teaching program has already been worked out, the purpose of which is to give the pupil a deeper knowledge and comprehension of computer technic and information. In it are two teaching variants--without a computer and with one. Presently in use is the "no computer" variant. Included in this teaching program are a great many basic concepts which should be known by everyone. Primarily because these apply not only to the organization of computer operation, but are the fundamentals of human operating functions in general.

I think that right now we should all, out of the thousands of tasks, crystallize a plan of action for the first year, then the next, and so on. It would be a mistake to tackle the whole complex at once.

B. APINIS: Which would be the first tasks?

J. KUZMINS: No doubt others will formulate them more precisely than I and voice their thoughts.

First, we should acquaint everyone with the personal computer. All available means should be utilized for this purpose. Radio, the press, and television, too, that people should become accustomed to the term "computer"...

E. IKAUNIEKS: Forgive me, computer (in Latvian)...

J. KUZMINS: ...Computer (in Latvian). They should understand that this device is no magic toy but a serious matter; with its advantages and also with its failings.

N. USTINOVS: The press, radio, television...popularization is, in my opinion, already the realization of set goals. Until then, as Jurijs Kuzmins, in my

opinion, correctly stated, we must choose the main directions in which--propagandizing, explaining and teaching--we must first, step-by-step, go. The main elements of the problems of "beginning computerization" could probably be, first: dialogue with the computer; second: the conception of algorithms; third: programming.

Of course, the means of mass information would have to enter this work very actively. Presently the psychological barriers in people's consciousness, when we start talking of the general widespread use of computers, is enormous.

U. GRINFELDS: Yes, yes but this barrier cannot be removed simply by agitating for programming, another way has to be taken! I think that, first of all, we should clarify in the people's consciousness what that means--to introduce computers. I, forgive me, will use the word "computer".

We, the adherents to computers, have a great many opponents, and their arguments, we must admit, are quite valid because very often the computer only complicates life. I too could name an example that tends to discredit this system. We had a chance in our publishing house to utilize computers as text editors. How nice, I really know how it is done--let us attempt to introduce this into the production process! In the results, the editor's job becomes more labor-consuming and the whole process lengthens. Instead of three, the material now has to be copied four times, because inserting it into the machine is the same as copying, but, as long as the text (a book, for instance) is not in the machine, I can do nothing with it.

N. USTINOVS: But once should be wholly sufficient--to write and insert into the computer!

U. GRINFELDS: Certainly! But only when the computer is not only on the literary editor's desk, but everywhere else as well, when there is a system.

Any new technique can only be effective when it is introduced as a unit. The same holds true for computer technology, the personal computers! If there is not a unified approach, then we are like people who try to hook a super-powered tractor instead of a horse to their wooden plow, thus hoping to achieve a tremendous increase in work production. The same holds true for computer technology--if in one place we install a computer, but leave a "wooden plow" everywhere else, the whole idea of computerization is discredited.

M. EGLAJS: I would like to add a few words, thinking more in terms of school computer information. In twenty work years many people have told me that they will have no need of a computer. But, the irony of fate, how often it has happened that these same people came back six months later and asked--just how could these computers be utilized after all and how to work with them! That is how it has been, and not just once.

We are preparing pupils, not for today, or even for tomorrow, but for the distant future. That is why, I think, the answer to the question, should we teach the basics of computer information and technology, is it not too early? can only be, it is not too soon; it is already too late. I am convinced that today the truth must be told clearly--there are no computers. And the "no computer" teaching is a kind of "ersatz" (substitute).

N. USTINOVS: Moreover, it must be realized that if non-computer training continues even slightly longer than dictated by absolute necessity, the results will be negative.

M. EGLAJS: Still, everything that is presently being done is the absolute necessity. To say, let us wait until schools, all schools, have machines and then begin--this we simply cannot afford. In the end, where is the dividing line? Should we begin then, when 60 percent of the schools have computers, or should we maybe begin when this system is in only 20 percent of the learning institutes? Should we put a computer in every classroom, or all in one? We must begin, as has been the case up to now, all in unison.

B. APINIS: It would be very interesting to find out, even if only approximately, how the individual and collective needs for personal computers will be further assured. Even though the news is presently not very encouraging.

U. GRINFELDS: Presently it is not possible to name total figures but the "contours" of the next five years in this area are approximately thus: in the last year of this timespan each region in our country should have a school equipped with computers.

M. EGLAJS: There is also this statistic for orientation--at the end of the five-year span every fifth school in the Soviet Union should have a computer terminal.

N. USTINOVS: There will be approximately 28 million personal computers in the country at the end of the century, of them 16 million will be in schools.

U. GRINFELDS: In order to comprehend the enormous volume of work let us take this example. There are 320 schools in Latvia. If in each one of these we want to install a complex with 15-20 computers, the republic needs approximately 6,000 systems. Latvia, in this respect, is approximately the hundredth part of the Soviet Union. Therefore, in our entire land 600,000 machines are needed for general education schools. Add to that the professionally technical school system--once again that many. Plus technicians, plus secondary schools. For education alone approximately two million are necessary. To begin with. I am not mentioning here the various scientific institutes that would snatch up the personal computers. Besides, supplying them will undoubtedly be the priority. We are talking only of schools.

What are our present production capabilities, Comrade Eglajs? How many "Agats", for instance, are produced in a year?

M. EGLAJS: The situation with the "Agats" is thus: simultaneously with information about "Agat" production comes the news that "Agat" production, as well as its program, has been crossed out. The greatest misfortune with the "Agat" is that this device, by virtue of its design is completely discrepant with the plan of making it a school computer. For this purpose the ESM BK-0010 is much more suitable. It too, of course, is not ideal but closer to the schools' requirements.

Our laboratory also participated in the discussion of the technical perimeters of our country's schools' computers. We submitted our suggestions, for

instance, that the construction guidelines of such machines foresee the possibility of using the computers with the various national alphabet letterings. Now these guidelines have been affirmed and exist in documented form.

We, on our part, have made known these requirements to those concerns in our republic who could manufacture personal computers. Such concerns are, for instance, the production unions "Radiotechnic", "Alfa" and "Vef". The Vefs, as they themselves recently confirmed, are ready now to manufacture their "Veformik", which would correspond to the schools' needs.

B. APINIS: Also in regards to price?

M. EGLAJS: That was a meeting with technical specialists, price was not discussed... At any rate that will depend on the volume of production. Unfortunately, in our republic today there is not the slightest hope that computers will be manufactured, even for the fulfillment of our own needs alone. "Vef" has its prototype but they do not have the production capability nor the space. There are places in Riga who do have the capability but presently the possibility of cooperation is remote.

J. KUZMINS: Price-wise too, the BK is presently the most approachable machine for schools as well as for home users--teachers and parents of students. We sincerely hope that in the next year the factory will ship 500 of these systems to Latvia. Of this total, schools could acquire 300 computers. We would attempt to distribute these computers to the Liepaja and Daugavpils pedagogical institutes and to several universities in Riga in order that they might acquaint themselves with the system and then help the other schools to master it. Such are the present plans. What will happen--hard to say.

The changeable alphabet has been talked about for some time, and not just by us. The BK is adaptable for alphabet changes. We have already completed a successful experiment! The long "A" was obtained--in a week's time. A couple of months more and the entire Latvian alphabet will be available.

A. BROKS: Is it not so that all the organizational and technical problems we have so far discussed would best be solved with the help of the republican goal-program? We have created enough of these, for various goals. Are not the tasks which must be accomplished by so many various departments in order to mass-implement computer technology worthy of such a goal-program? We have a strong electronic industry and we manufacture quite good consumer electronics. Of course, it will be difficult to start up, but that is not an insurmountable problem. We must join forces for, after all, this is all part of our republic's economy. If not more, then at least enough should be possible to satisfy our republic's own needs. I, of course, understand that it is one thing to review everything here, then, at the table in the Cabinet, it is quite something else again...

J. KUZMINS: There is another aspect--who will repair, who will maintain the computers? Allright, so we receive the 500. If there is no proper maintenance, the computers, in the hands of beginners, will one and all be down in half a year. Who will assure maintenance? "Impulse"? It is not presently apparent that this manufacturer is ready for this. Even when the computer is a

relatively simple device, it has to be inspected by a specialist at the time it is uncrated. The user too, let us say a teacher, has to be instructed by a specialist the first time.

B. APINIS: But there is a book of instructions...

J. KUZMINS: No, these cannot replace a person! It has to be demonstrated.

M. EGLAJS: Not that it solves the problem, but presently this "reloading point" role has been assumed by our school computer information laboratory. We will examine all the computer apparatuses destined for the schools and will try to demonstrate the most essential operating techniques to the individuals who come to pick the computers up.

N. USTINOVS: Right now it is very hard with the computer technic. Still, schools should be protected from a very dangerous trend in their relations with the patrons. There is more than just one precedent. The patrons--such organizations or enterprises as have computer technic--try to "push off" to the school the old, large computer machines that can be written off. Real monsters. No one will derive any benefit from these, least of all the schools themselves. Even though the patrons promise all the world's benefits and swear that they will undertake the prophylaxis of the systems, etc.

M. EGLAJS: It would seem that lately the schools have grown more cautious. We too are trying, as much as possible, to advise in this matter. Still, it will not be superfluous to remind the schools once more not to take, without consideration, the patrons' old junk.

R. BOKANS: Unfortunately, I have in my possession quite recent information from the Ministry of Education about attempts by patron-organizations to force such bear-favors.

M. EGLAJS: There are also counter-instances. For example, the manufacturing union "Alpha" has begun the construction of a computer center in #23 High School in Riga and will set up there, not an old machine, but an adequately new one, one that even a university would be happy with--the ES-1033.

R. BOKANS: The "Vef", on its part, has promised to establish a computer class in the #64 High School.

J. KUZMINS: Those are exceptions. There are very few such organizations who can afford this. The others should not have to go this route.

N. USTINOVS: It would be another matter if the possibility were found in a patron-organization to free some time in their computer room and this time were spent under the guidance and leadership of a qualified specialist. Such a trend, to invite students to modern computer rooms and instruct them with modern terminals, could only be lauded.

A. BROKS: The State University of Latvia is the base concern for the Riga #1 High School. During this academic year we will be working with tenth and

eleventh graders in a 2,500-hour total timespan on its materially technical basis. It will be necessary to maximally strain the enthusiast forces, even to the sacrificing of this or that. Of course, even these efforts will not be able to satisfy all, for many, many more are those who wish to acquire the basics of computer technology.

E. IKAUNIEKS: I would like to say that teachers are generally optimists. Every day someone comes to our chair and inquires, which machine would be better to purchase, the BK or the "Agat".

P. BANKOVSKIS: Maybe you could tell us in more detail about teacher attitudes. It would be very interesting to find out how things went for them during this summer's courses. This after all, was the first general education school teachers group in our republic who became acquainted with the electronic computer, worked with it and, having acquired its concepts of it, will pass their knowledge on to their students. How were hopes reinforced? How were misconceptions dispelled? Were the comprehension barriers high?

U. GRINFELDS: First of all, it must be said--the interest was tremendous. I read lectures to not only those teachers who will themselves have to teach computer information in schools, but also to other groups of pedagogues--primarily mathematicians and physicists. I was invited for various lectures to auxiliary school instructors as well. What surprised and cheered me most was how interested and active were the pedagogues of particularly these learning institutions. Yes, they said, we understand that we will be the very last to be issued such computers, still...

No doubt the general interest was due to its share of pure curiosity, but that is not bad either. At any rate, I can positively state that skeptical voices were heard much, much more seldom than we had expected.

E. IKAUNIEKS: During the time of the course I did not hear a single negative remark or pretensions that something was not understandable or necessary. There was none of that. If someone's thoughts went in this direction, then, influenced by the general mood, he did not say anything.

M. EGLAJS: If we are speaking of a barrier, then, in my opinion, the decision, right at the start of activities, to give the course participants the opportunity to work with the computer in the regime "programming without programming" was successful. In working with the special programs--the games--in most instances any unfamiliarity barriers between person and machine disappeared in approximately 15 minutes' time.

P. BANKOVSKIS: Even though "hands-on" difficulties did not generally take place, no doubt you had the opportunity to observe characteristic computer errors during these first moments of "dialogue". Assuming that, sooner or later, not only for teachers and students, this first moment of direct confrontation between man and computer technology will come, it would be most instructive to hear a word...

J. KUZMINS: The first encounter...the most important, the very first is an error of methods; an error of the instructor himself. We cannot begin with

the complicated. Experience shows, and Comrade Eglajs' just-mentioned confirms it, that instruction is most correctly begun with the help of games. This in order to show the person that the electronic computer machine is a friendly "creature". In the beginning the complexity of the electronic computer should be purposely concealed, and only gradually should all the complexity that is hidden in the machine and what it is capable of be revealed.

N. USTINOVS: So that the person, right at the start, might reassure himself, with the help of games, that nothing will happen if he presses the wrong key, nothing will explode or break...

E. IKAUNIEKS: Such fears apply only to teachers. That is their problem. Pupils press everything that they can get at...

U. GRINFELDS: During this summer's courses we tried to influence the teachers approximately thus: this is the first year, the year of practice and experiments. If it does not turn out, if the teacher feels that he cannot completely realize the teaching program, then he needs to give something up. That--first of all. The second thought we put to their hearts--to teach with the help of examples. This is indicated in the teaching aids, too. If possible, more concrete examples, that there might be models to follow. With the motto--do as I do!

Thirdly, the instruction booklet should always be up front, on the table. Obligatory. Also during test time. Let them thumb through it; let them find what they need! It should not be required that children learn something by rote. The most important is to grasp, to understand, not to hammer in. It seems to me that if pupils thoroughly grasp even the concept "cycle", much will be accomplished.

Once I really got it though for such talk in a teachers' auditorium. After the lecture an employee of the Ministry of Education cornered me. Say, what are you talking about, the teachers will generally not be teaching much...

In the program, by the way, demands are quite uncomplicated: "the pupil must be introduced,the pupil must gain a conception of..."

E. IKAUNIEKS: But right next to it--horrors!

U. GRINFELDS: The old trouble! In all instances where formal rules must be adhered to, or the post-script must be in formal language, the likelihood of exaggeration appears in the learning process. If the teacher does not completely orient himself with the subject, he could start asking for only the formal side. The requirements of the program also open up to such a route.

N. USTINOVS: The perscribed formal teaching mechanism must be utilized in any subject. Unfortunately, the characteristic of the new subject is such that the mechanism is more complicated than the processes themselves, which can be set forth. Every teacher should understand this so that comprehension, not inculcation, might be accomplished after all.

U. GRINFELDS: That sounds good, but teachers have examinations "from above". Pupils will have to take tests during this examination time. The requirements of the tests will no doubt be very formalized...

A. BROKS: A name for this phenomenon has been found some time ago--"the academicians' sickness". Science workers ascend to such clouds that to fly back down to earth and understand the poor pupils is no longer within their power.

Moreover, in order to deal with the learning program which is not at all perfection itself, perhaps it would be useful for ministry workers as well to acquire a deeper understanding of computer information and technology.

B. APINIS: Not without reason has academician Jershov often stressed--all must learn.

R. BOKANS: Otherwise even with reference to calculators, schools hear--do not purchase; there are no directives for that!

U. GRINFELDS: Now that is absurd, a totally wrong approach!

E. IKAUNIEKS: If computer illiteracy is to be liquidated in the entire land, then those people responsible for organizing this liquidating process in the schools really should unite with all those who are presently educating themselves along these lines.

B. APINIS: Without the help of a knowledgeable teacher, learning is, of course, rather difficult. But without a good textbook it is not easy to study either. Everyone wants to learn, pupils as well as those whose school and college years are behind them. Possibly more so than for all the others, a good book about computers would be necessary for the latter. Presently such literature has not been noted--neither in school nor stores.

That is why I hold in my hands like a treasure Jurijs Kuzmins' authored systematic instructions for teachers. This brochure will surely take an honored place on the bookshelf along with works similar to those of such authors as Andzans, Ikaunieks and Grinfelds. Then we have the tireless Tomass Romanovskis with his books on pocket calculators. But that is the extent of it in Latvian. How does the future look?

U. GRINFELDS: Well...I will try to say a few words on this subject, although I can only talk of the accomplishments and plans of the Zvaigzne Publishing House.

Recently an instruction aid in the basics of computer information and technology language of the All-Union scale. We have translated this book. We set a speed record in the republic. Everything--the translating and the editing--we did everything in a month's time. RPI docent Indulis Strazdins translated the book. Almost simultaneously with this the book you mentioned for high school teachers, whose authors are Andzans, Ikaunieks and myself, was written.

B. APINIS: Still, a school textbook in Latvian has not yet seen the light of day.

U. GRINFELDS: I am not competent to discuss its further progress. The publishing house accomplished its task timely and very fast.

B. APINIS: This time everyone's hopes were dashed by the "Cina" typographers. The printing of the book has not begun as yet. We will just have to wait.

Please tell us what are the future plans of the publishing house regarding literature devoted to the science of computer information and technic? Will we be receiving any books intended not just for pupils and teachers, but could interest a skeptic as well and would simultaneously be useful to various interests and age-groups?

U. GRINFELDS: Well, plans for the future are not rosy. The publisher's tasks for 1987-1988 have already been established and there are no such books in them. There are no such books in our manuscript portfolio either. Part two of the pupils' textbook has to be issued yet. This we will accomplish outside the plan. But otherwise...

Yes, there is one pleasant exception! Tomass Romanovskis has prepared an expanded and revised repeat edition of his book, "The Computer, at Work, in Studies, at Play". This reading matter was just now highly rated at the Moscow International Book Fair. We have been given the opportunity to distribute Romanovskis' book and its Russian language variant to other publishers in our country where it will be translated into the languages of our sister-republics. Of course, we will issue the book in Latvian, too. In my opinion, this edition has been written in a very original manner and is replete with good examples and problems that are witty as well as easily understood and very interesting. The conclusion of the book is devoted to personal computers in the BASIC language. I would highly recommend this book to everyone who is interested in computers.

B. APINIS: Only regrets must be voiced that there is so little of such literature in our republic, and we must hope that potential authors in Latvia will be more active in the future.

A. BROKS: It would seem there is yet another way in which we could stimulate interest in computer technology quite effectively and not just in one lad alone. We have practically not mentioned those people at all who have built their own personal computers. Good computers. Maybe such enthusiasts will be rather hard to find among pupils, but among young physicists, mathematicians and engineers they are not few. Perhaps in this way we could remove the veil of mystery that seems to cover the electronic computer.

U, GRINFELDS: Yes, these people are really worthy of recognition and respect. Still, one of the questions that would have to be put to each is--where did you get the micro-schematics...

M. EGLAJS: The necessity has arisen for a club. A personal computer and programming enthusiast club. There are enough fans, in Riga as well as in other Latvian cities. Pupils and adults. For instance, in Rezekne there is a splendid group of enthusiasts.

E. IKAUNIEKS: And the high school boys who walk around with our and programs found in foreign magazines in their hands! Who busy themselves with programming, with me, with Eglajs in the laboratory, or in the Polytechnic Institute. I must say I cannot imagine at what time they attended classes...

J. KUZMINS: Those are the same ones who come to us as well, to the display hall of the Solid Physics Institute.

A. BROKS: The club will certainly have good patrons. In the "Vef", for instance, the need for talented programmers grows daily. Where else is it possible to raise them "from the ground up" if not in such a club? No doubt the club patrons, with combined efforts, will be able to solve the material supply problem as well.

B. APINIS: The need for such a club is no doubt also dictated by the fact that even less than technology are we assured of programs. Here by us they are practically non-existent. Not in a single area of life, in which such a device could function so splendidly, which we are presently lauding so variously--personalist, personal, maybe--individual computer.

M. EGLAJS: Oh! If those present do not object, I propose we postpone discussion of the subject--program assurance, to another time. Such a prickly, multi-faceted problem is worthy of special discussion!

U. GRINFELDS: We can only agree with Comrade Eglajs. One comment. No matter how many programs we purchase, no matter what kind we work out ourselves, there are no universal programs. We cannot, having created in a laboratory, for instance, a physics instruction program for high schools, give it to all physics teachers and say--now, work with this! That would be about the same as pointing to some outstanding pedagogue and saying--everyone, educate according to his method! Every teacher is an individual and his thoughts on how to teach have to "go through himself". So it is with a program. Everyone will want to insert in this program a little bit of something else.

M. EGLAJS: It would be ideal if the teacher would come to us and say--you know, your program is not bad, but I would formulate it differently. That does not mean that teachers will have to enter into all the depths of programming technology. As up to now, he will have to know his subject and will have to know how to integrate this knowledge with the computer's capabilities.

A. BROKS: Not forgetting for a moment that computer technology by itself can not create anything. The worth of the person at the computer will be the worth of the computer itself. A master's hands at the personal computer are indeed a mighty work tool, but the sluggard and the fool, working with such a system, could sometimes even cause harm.

N. USTINOVS: Life will be harder for sluggards in schools in any event. Presently they can still hide in the crowd. In the hands of a master the electronic computer will indeed be a mighty tool. But it will also help any of us to function more effectively than up to now. Life will be a little easier.

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SPECIAL TRAINING REQUIREMENTS, PROGRAMS ADDRESSED

Leningrad LENINGRADSKAYA PRAVDA in Russian 29 Dec 85 pp 1,2

[Article by S. Grachev:"A TImetable for a Robotics Technician"]

> [Text] The bell had rung an hour ago and a storm had literally swept through the school. The doors to the auditorium had slammed shut, hundreds of feet had shuffled along the stairs and voices had rung out in the vestibule. They had fallen silent. There was silence everywhere and the fact that the evening was turning cold outside the windows had become noticeable. And then new sounds were heard in the seemingly emptied building. Electric guitars began to hum and tune on the first floor. Someone walked along the corridor with a tea pot. Apparently everything apparently had not yet changed and a young man, flame-red headed and bright as a sparrow, young man of high school age flew into the room where I was seated with Natalya Anatolyevna. "Where is the computer club?" he blurted out and then immediately disappeared, literally blown away with the wind and without saying "hello" or "good-by".

In short, life in Professional-Technical School No. 38 on the Petrograd side of Bolshoy Prospekt was taking its normal course. But its rhythm was a little slower and the situation was homey and comfortable. N. A. Kryuchina, an expert in industrial training, and I were holding a discussion on a captivating subject, the profession of robotics technology, in this environment. By the way, this was not an abstract discussion, but instead centered around a specific representative, Vladimir Sokolov.

This Sokolov was noted for his independent judgement and clarity of purpose. After completing school at the "good" and "outstanding" level, he did not enter a VUZ [institute of higher education] because he had become interested in electronics and a specific profession. He quickly settled into school and was fascinated by technical creativity. His last work, completed along with Mikhail Sergeyev under the guidance of engineer A. V. Kuznetsov, is a universal training work position to be used by repairmen for versatile production systems. Itis now being demonstrated at VDNKh [Exhibition of Achievements of the National Economy of the USSR] in Moscow. His exhibit has

already won a number of awards. Moreover letters from all over the Union have arrived at the Leningrad school with offers from reliable customers.

"It is most probably easy to work with such students?" I asked and Kryuchina smiled at my naivete.

"It is easy with the manageable ones, but I have some that have their own opinion about everything," she explained. "Take Sokolov. He didn't take a single examination for six months on principle. Why, I ask. And he never agrees with the instructor. What do you do with him, give him a certificate instead of a diploma? And how do you urge him on? Yes, the chiefs help... 'What do you want, a certificate' and they begin to worry. At the same time Sokolov passed their training. 'Volodya has golden hands. We will have a talk with him, he will take this examination, we certify...'"

This is the way these robot technicians are. They are our contemporaries, but at the same time, they are workers of the 21st Century. For the most part they are yesterday's school children, people who have been captivated by the profession and the challenge, and who, of course, are valued and awaited at enterprises. This is certainly how it has to be, but why are the brigadiers, experts and chiefs of cadre departments especially interested and giving special attention to the fates of these lads?

Natalya Anatolyevna gave me an unexpected answer to this question. "If you want to know, the Sokolovs that we have are beyond compare. Even yesterday it was possible to train a worker right in the workshops. Not with the same high quality and not with the same fundamentals, but in principle it could be done. But today people can be trained for new professions only in PTU's [professional-technical schools].

The Key Position

In the last three years the professional-technical schools in Leningrad and the oblast have trained nearly three thousand workers in new, difficult professions. These people have become repairmen for machines and manipulaors with numerical controls, computer operators, and computer repairmen. Initially, according to the territorial and sectional Intensification-90 Program, several schools were used to train them. Last year there were 15 such schools and this year there are 33.

By decision of the central board, SPTU-38 [agricultural professional-technical school] was to be among the first to train specialists in computers and robot technology. The number of groups to be trained was unknown, the base was unclear and the program had not been worked out. And while all of this was being explained, the school was allocated space to accommodate the future laboratory, floors there that had rotted were peeled away and dividing walls were dismantled. They did not waste time, but they also did not panic. This is how things stood in April 1982 when management arrived to familiarize themselves with how the work was progressing.

"Are you constructing the laboratory? Wonderful. Show us"

Director V. A. Korol pointed out the laboratory where construction chaos ruled. This picture had a depressing effect. Only one guest was not disheartened.

"Do you have any paper and a felt tip pen?" he asked the director. "Then write ROBOT EQUIPMENT LABORATORY and hang it on the wall here. Yes, excellent. And now explain to us how one gets admitted to the new profession. Do you have any questions?"

The director certainly did have questions, but his naturally sharp wit and an innate feeling of tact prompted the young director as to when and to whom he could direct them. His path to a retreat was cut off and so after smiling in an unsophisticated manner, the director answered, "Everything is clear."

Before coming to this school, Vladimir Ivanovich had worked for three years as the deputy director of an "organization" that was a neighbor to the Petrograd side of the PTU. He did educational work there although his own education was that of an electrical engineer. The diverse experience was especially useful now, for it was felt that things would certainly have been in ruin without his special knowledge and technical mental outlook. Korol went to the directors of the primary enterprises and asked for the latest equipment.

"And how many of these robotics technicians do you intend to train?" they asked and after hearing his answer, they smiled. "These workers will cost us a pretty penny."

"They will be even more expensive tomorrow," said Korol without giving in. "According to your developmental plan, it appears that in two years you will have a flexible line in operation. Who will service it?"

And so the school is well equipped. The school had to attract highly qualified specialists. And they school still had to find and generate ideas from these people. Moreover the school had to convince them to switch over to lower paying jobs. For example, the authorized PTU table had no programming engineers and to this day the director pays them from profits which the school gets from its production activities.

And the experience from his educational work has already proved useful here. The people were found. Young engineers such as Komsomol members A. V. Kuznetsov, L. E. Blinova, Ye. V. Danilov and Ye. D. Gurevits came to the school, a robotics equipment laboratory was set up and the school got its own computer center in the empty space. N. A. Rozovskaya and N. V. Galuza began developing training programs using computers.

By the way, one of the first questions they had to answers was "What were they to teach future robotics technicians and computer operators and how were they to create models for a profession that still did not exist?

Nonna Mikhaylovna Martynenko explained, "From time immemorial people have learned by the principle of 'Do as I do.' There have always been examples in life and in production that one could imitate and one could always study the foremost experience. But we had none of these things. Today technical

progress is going so fast that the PTU has to make up its schedule for the 'day after tomorrow'."

And they have made up these schedules by considering prognoses from industry and recommendations from practical workers. Supplements were constantly added, the best things were harvested and at the same time people have developed what they here call the general ideological approach.

What exactly is this?

Korol said, "Economic intensification demanded that we not just provide workers with new specialties, but rather that we reach a qualitatively new level of training."

Is would seem that this is trite and so I should explain what people in the school see under this concept and why they therefore focus so much attention on it. As is known, contemporary technology, and this covers the equipment in workshops, sites and enterprises, does not require a great number of workers, but every one of these workers is subjected to immeasurably higher demands. Take a situation on the line where there is breakage because a worker is poorly qualified and you have to estimate losses at tens of times the previous rate.

Here is another argument. Contemporary technology does not stop while novices complete their training. Novices have to start working immediately or not at all. There is only one way out of this situation and that is to train a novice so that he can be entrusted to work immediately and without fear.

This is why people here have thought about standards of quality, an entire system of measures that guarantee the necessary level of training, and why they are using the latest scientific and methodological work-ups. For example, with their help a computer operator can learn to touch type at more than 100 characters a minute in a total of four days. And a worker will be able to learn speed-reading, programmer languages and so forth in the future.

Let us look at the practical side of training. Training is conducted only when useful products have been issued. Articles "for the waste paper basket" have been rejected as being the work of people who have lost their spirit. In practice, people in a school workshop and in a factory are totally responsible for their own work and and receive real money.

By the way, there is a product bearing the stamp "made in the PTU". I'm not alluding to hammers or switches, but rather to very complicated equipment designed for diagnostic work in automated training systems that are based on microprocessors and training programs that are recorded on magnetic disks. The school issues a quarter of a million rubles of this "merchandise" a year.

Finally, the quality of knowledge depends on the intensity of the lesson. Personnel are studying the course "Fundamentals of Information" (and there will soon be other subjects) at computer terminals. Each can select any level of task and and the minimum or maximum program depending on his ability and training. The computer checks each one and will prompt and explain things.

The instructor is then left with the most difficult and creative part of the lesson, working with those who are lagging behind. But as a result of this method, the number of people in this latter group is several times less than usual.

Here is what makes up quality.

A Promise Is A Promise

Professional-Technical School No 38 is operating under very usual, and certainly not privileged, conditions and it has the same problems that other PTU's have. Still, what was the primary thing that helped in the formulation of the school.

"Ties," was the short answer I was given.

I didn't understand.

"Business contacts," explained Vladimir Ivanovich. "The future of every school depends on its relationship with its customers."

"With the chiefs," I said, getting more specific, but the director gently corrected me.

"With the customers. Because if there are chiefs, there are assistants. We are all equal partners who do not do services and favors for one another, but who instead work for our mutual interest and advantage."

But I retorted, "But there are certainly different possibilities. Let's assume that you promised, let's say, 30 machine operators, but there are no candidates. Where do you get them? How can you graduate them?"

Korol looked at me severely and said, "No one is interested in where you get them. You gave your word and so you have to graduate 30. You can give birth to them yourselves, but you graduate them and that is the essence of the matter.

In economic terms, the relationship between a professional-technical school and its base enterprises is taking on more and more of a self-supporting nature. An association or factory does not provide assistance to a school formally or through duress, but does it according to the reality of its return.

As to expenditures on training a worker for new professions, they are indeed very significant. For example, let's say that a half a million rubles of equipment has been purchased for PTU-38 and in another school, No 83 for example, equipment costing about three times as much has been purchased. The cost for training graduating students has also become correspondingly high. This is why, figuratively speaking, this robotics equipment today costs more than average equipment.

All of these expenditures are justified if all PTU graduating students enter the base enterprise. But we have already said that robotics technicians are not distributed in groups, but rather by two or three people. Does the enterprise recoup its "expenses"? On the one hand, it costs a pretty penny for the school to train ten or twenty people for the equipment and the personnel to service it are very expensive. How can we maintain the mutual interest between the base and he professional-technical school under these conditions?

PTU's that were the first to start the intensification program gave us the answer to this question. They expanded their business contacts and have begun to train workers not only for one or two enterprises but for an entire field or for several fields, and, by direct agreements, to train workers for enterprises that do not have their own schools.

The factory gets workers and the school gets equipment and a computer. With the help of these agreements, many schools have already developed the conditions for training modern professions. These are conditions that the enterprise itself could not provide for the student. And this is not only technical equipment, but also qualified instructor cadres, corrected methods and training levels. Naturally the question that comes up is why does the professional-technical school not conduct retraining courses for base enterprise adult workers to increase their qualifications and why does the PTU not have practical, as well as theoretical courses, as opposed to the usual evening courses?

Here are the levels of development. FIrst, there was the industrial school, then the professional-technical school with its secondary education and wide training profile. Now, on the onset of the five-year plan we see that the best of these are being transformed into distinctive centers for inter-industrial training and cadre retraining. These are technically equipped, paying concerns which have a good training base, their own production and training experience. This in principle allows the school to be reorganized rather rapidly and to train cadres for developing industries "on order". A flexible educational training system, a reference mark for the 12th Five-Year Plan, is thus being developed.

What do we have to do to get to this point very quickly. First of all we have to regulate the schools' structure and regular schedule. For example, approximately 20 people are involved with servicing training and production equipment and the computer center alone. We remind you that the school keeps these people out of production activities. This situation is legally permissible, but is inconceivable from a practical point of view for the salary for highly qualified specialists in such a system is much less than they would receive at industrial enterprises. And on the same plane, it is time to give the school director more independence, one equal to that of his colleagues in industry.

And schools that are training workers for new professions also need methodological assistance. Yet pedigogical science is still delaying this assistance. Production training instructors and experts are relying on their own efforts and past experience for the most part. And what if there is no

past experience (especially in the field of computer training)? And last, there is the very model, the structure of the training center. It must also be thought out and optimized with the help of science.

Should We Have Competition Again?

This fall SPTU-38 completed its 40th year of operation. Older inhabitants tell us that in post-war years competition for one training slot here was better than many VUZ's even dreamt about. People stood in line the evening before so that they could turn in their documents in the morning.

Today, despite the fact that the school is favorably coping with its admission plan, the situation has changed significantly. For example, a significant part of the tenth-class students enroll in school after failing entrance exams for VUZ's. And this pertains not only to future robotics technicians and computer operators, but also to machine operators, metal craftsmen-assemblers, electricians and more.

Many people come here for the red diploma with which they intend to again try their luck at a VUZ the following year. Sure, a lot of time has passed and young people's plan are changing radically. An insignificant number now plan to go to an institute. The remainder, including those with red diplomas who have the right to become full-time students by taking one examination, primarily intend to work.

Nonna Mikhaylovna Martynenko said, "According to our calculations, approximately 60 percent of the young men and women enter school by chance. And the overwhelming majority do not intend to change their profession upon completing the school."

How can we set up educational work so that a graduate student's baggage of habits and knowledge is not cheapened by his careless attitude toward work, his lack of conscientiousness and his indifference? How do we in a relatively short time foster in a man respect both for his work and for himself as an expert and develop in him that which Pavlov called the "goal reflex", the persistent, indomitable craving for improvement?

"We talk about education a lot today," answered Vladimir Ivanovich, "but we talk more and more about education during free time, where people live. And we forget that man devotes the greater part of his time to studying or working. This is primarily how he develope s."

People in the 37th SPTU feel that people must be educate primarily during classes held in the workshop or laboratory, that they must be educated by using a specific pursuit and by taking strict account of the work that was performed and the efforts that were expended. A novice must feel from his very first steps that his later situation and prosperity depend primarily on his efforts and his work.

This fall the director had several unpleasant meetings with parents. Their offspring were refused admittance into difficult professions and they saw this as an infringement of their civil rights. One father was incensed and said,

"We are all equal and you are obligated be concerned to the same degree about everyone."

"And why doesn't your son select a easier profession?" continued Korol.

The parent left after promising to write his complaint, which, by the way, did not frighten the director. On the contrary, he was happy. For all that, they were not complaining because they had been sent to the PTU, but because they had not been accepted.

"The sad thing is that all the same someone will have to work with this fellow," he explained. "And why? Because what has happened is that this fellow studied until he got his degree, until he was an adult, and he feels that this is all he is obligated to do. Where did young people get the idea about 'boundless' equal rights. Well, one thing is true -- opportunity and diligence are different. How can they still not know this simple truth."

The "inverse link" is very important for us in education today and so is evaluating young men and women by the results of their work and by the effort that they expend. And therefore life has proposed evaluations to them not in 10 to 15 years, as one frequently hears, but faster. This strict accounting, that success and failure depend on the work that one has put in at school, is indisputable. One can transition from a group where it is easier to learn into a group of robotics technicians, and the reverse is possibly true, but the best and the worst on merits change places. This is exactly how people here award a ranking -- by shop criteria, where a man has his practical exercise exactly as it is writen in a reference for entrance into a VUZ.

"But will the PTU have entrance competition or not," I asked the director at the end of the conversation and he smiled.

"They certainly will!"

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THE THREE FACES OF 'IMPULSE'

Tallinn SOVETSKAYA ESTONIYA in Russian 19 Jan 86 p 1

[Article by A. Krotkov.]

[Text] Despite being minimally informed on questions of computer technology, I was easily convinced that this Agat (Agate) school computer was back in working order after repair: at that moment, the diagram rising on the screen seemed to register the peak of my emotional state, and it fully corresponded to reality. The machine had just demonstrated its capability as a chess partner, it "produced" several colored patterns outside the prescribed program to help a young knitter and, without being connected to a magnetic recorder, produced a pretty Bach melody. And the whole group of five serious men assembled around the computer smiled like children.

However, at the "Impulse" plant more than one electronic marvel is causing joy. This is a young enterprise, rapidly growing and very much needed by every branch of the republic economy, as it is engaged in the service and repair of computing equipment.

"Our volume of work has doubled during the past five-year plan," relates the chief engineer of "Impulse," A. Kislitsyn. "Now, under the guardianship of our electronic technicians, there are about a thousand computers of various types; together with duplicators, calculators, and typewriters, there are 14,000 units. With a staff of 230 people, including branches in several regional centers of the ESSR, such a workload, you will agree, causes certain difficulties. It is true that while we occupy a prize place in social competition, systems of analogous enterprises of the USSR Central Statistical Administration also fulfilled the 1985 plan ahead of schedule, but the drastic growth in computerization foreseen in the draft Basic Directions will undoubtedly require both growth in computer service personnel and organizational and material strengthening of the repair base.

After becoming acquainted with producers, one can be convinced, one can be convinced that the "Impulse" collective is actively preparing itself for the growing complexity of the problems facing them. Here, systematic studies have been arranged for personnel, not only for beginners, but also for masters with high qualifications whom practice constantly forces to renew experience and knowledge, to master the structure of more up-to-date machines produced by scientific and technical progress, including that abroad.

Imported manipulators have been obtained to automate spare-parts storage. Soon the spare parts will be placed in an already constructed spacious building and the manipulator, moving along shelf racks, will "itself" search out the needed component from among thousands of others.

Useful improvements are being introduced by mechanical-shop workers who often have to fabricate missing parts, especially for repairing typewriters.

In a word, vitalized work is being conducted along all three lines that are characteristic of "Impulse," which combines the look of a scientific institution, that of a service bureau, and that of an industrial enterprise. The staff also is selected with such characteristics in mind. Preference is given to young people with secondary technical education who meet innovations with enthusiasm and are not afraid of hand-to-hand combat with the whims of electronics.

For example, there is a "veteran" of the plant, Anatoliy Smyshlyayev, a sixth-rank electromechanic who, in the past, was a navy radio operator and a graduate of a naval school. He has been at "Impulse" since 1978. Today, he is a high-class specialist, a member of the party buro, and head of a people's control group at the enterprise.

"What to you especially remember about your work; have there been any funny incidents?" I ask.

"I often remember a trip to Narva, to a GRES," answered Anatoliy, without long thought. "There, they reported, they couldn't get two new computers from a Smolensk plant to function. Well, I think, I am going to have to work hard: machines of this make are, unfortunately, not distinguished by their reliability. And actually, the first day I was there, they continued to malfunction, although I could not find any defect. But, the following morning, I found the problem: the Smolensk assemblers had simply gotten a little bit confused, let us say, and two wires had to be interchanged; that was all. Usually, you have much more serious failures; Yuriy there will verify this."

Yuriy Ignatyev is a brigade comrade of Smyshlyayev's and is also one of "Impulse's" best workers and a deputy of the Tallinn city soviet.

"Repairmen often evaluate the quality of a piece of equipment more accurately than the manufacturers. A computer is no exception," says Ignatyev, soberly. "On the basis of our own experience, we know how much more convenient the recent models of high-speed compact machines are for operation and repair: now, a mechanic rarely has to crawl on the floor to find damaged blocks that are positioned low. You can carry a whole computer to the plant, or a whole block or block part. But for this, plant automobile transportation is needed and already there is not enough of it now. True, the problem is being solved, but it should be hurried up -- idle computers waiting for repair cost the state a lot of money. Incidentally, this should be taken into account also with respect to the production of spare components: there are still many shortages.

It appears that Yu. Ignatyev's concerns are close to those of the whole, small collective at "Impulse." Beginning this year, for example, the plant has to serve

schools that are being supplied with computers. How many of them will there be by the end of the five-year plan? The number may turn out to be unexpectedly large. And it is comforting that at "Impulse" they are oriented just for such unexpected occurences.

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- END -